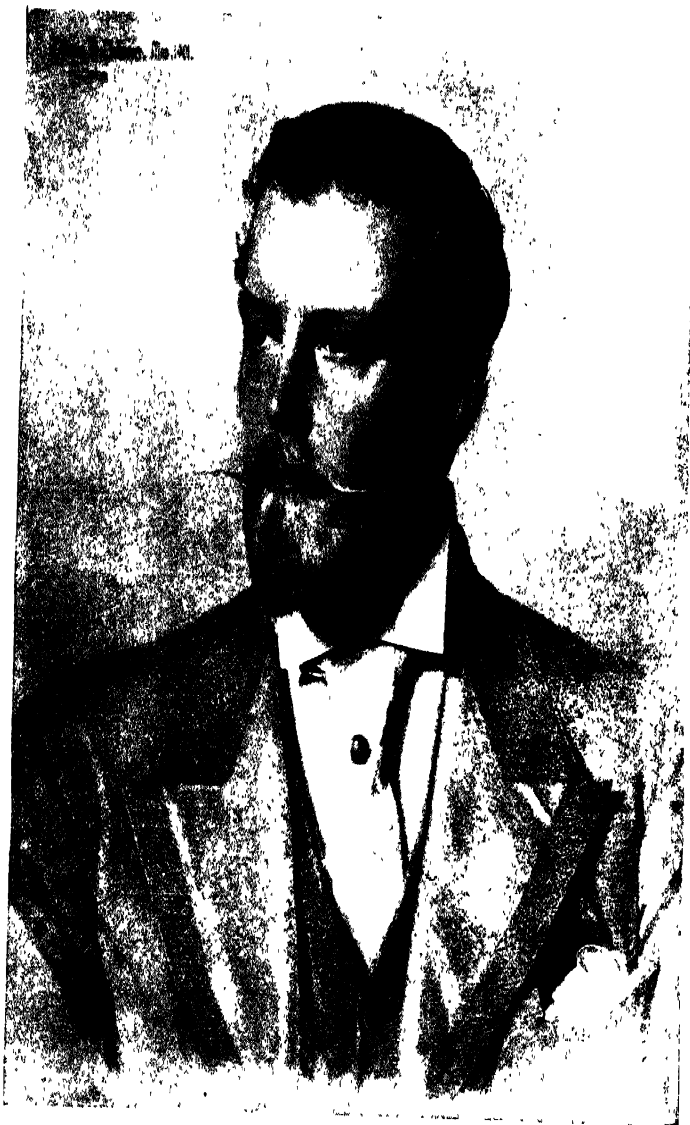


The British Journal
Photographic Almanac

1908


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PREFACE.

The most notable revision in the present ALMANAC is the division of the advertisement index into two parts, one an alphabetical list of the names of advertisers and the other a classified index of the goods advertised. This latter is a new feature, and will, it is hoped, be appreciated both by readers and advertisers. The ALMANAC is now provided with three distinct indexes, that referring to the text pages, and the above two affording an equally precise guide to the advertisements. These, as also the alphabetical list of the photographic firms, with their postal and telegraphic addresses, are placed at the extreme end of the book.

The frontispiece this year takes the form of the portrait of the late Thomas R. Dallmeyer, from the painting by Sandys, which has been well reproduced in three-colour by the enterprising Middlesborough firm of Hood & Co., Limited. Years ago the portrait of a photographic celebrity was frequently selected as the frontispiece of the ALMANAC, and readers will no doubt still welcome the occasional presentation of a portrait representing one or other of those whose names are household words in photography.

Other features of the ALMANAC which have proved popular in the past are retained in the present volume, which, it is satisfactory to say, has contrived to compress itself within somewhat narrower limits, and it only remains to thank all those who by their suggestions or assistance have lightened the work of editor and publisher, and to offer them during the interval before the appearance of its successor any help, which may be possible, through the weekly issue of "The British Journal of Photography."

GEORGE E. BROWN.

Editor.

24, Wellington Street, Strand, London, W.C.,

November 1, 1908.

LONDON HENRY GREENWOOD & Co.,
Publishers of *The British Journal of Photography*,
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OBITUARY OF THE YEAR.

Among those whose deaths have taken place since the publication of the 1908 ALMANAC are :—

A. Horsley Hinton (Feb. 25, 1908).	John A. Hodges (Oct. 25, 1907)
F. H. Wenham (Aug. 11, 1908).	H. S. Mendelssohn (Jan. 24, 1908).

A. HORSLEY HINTON.

The sudden death of Horsley Hinton in February last, as a result of a few days' illness, came as a shock to the photographic world. Though only forty-five years of age at the time of his death, Mr. Hinton had long been a dominating personality in the photographic world. Since 1893, as editor of the "Amateur Photographer," writer, lecturer, and organiser, he had taken an important share in every movement which has stirred the ranks of photographers. Entering photography through a commercial firm of dealers in photographic goods in the city of London, he at once showed his aptitude for writing and his championship of photography as a branch of fine art by editing the "Photographic Art Journal," a periodical which ran for four years. During this period Mr. Hinton's writings on photography as an art appeared in many publications, and his unremitting claims for the recognition of the camera as a means of pictorial expression did not lack the productions of his own instrument to give them force. Apostles of pictorialism in photography there had been before, but none who so persistently and forcefully, with camera and pen, waged war against those who would have denied photography a place amongst the arts. Mr. Hinton was more than an important factor in the movement towards what is known as "pictorial photography." He was essentially its creator, and he popularised it among the large body of amateur photographers whom he could address week by week. Himself a skilled worker in the photographic processes, Mr. Hinton's writings, especially in the earlier part of his career, were distinguished by the

communication of much detail of manipulation, conveyed with a literary style of considerable charm and vigour.

On the inauguration of the Photographic Salon Mr. Hinton was one of its most enthusiastic supporters, and for some years, after the death of Mr. H. P. Robinson, its moving spirit.

In photographic politics he was involved in many a stern fight, and was often both misunderstood and misrepresented, but those who knew him best, and were often his opponents, knew him as a fair, generous fighter, and as one who never, knowingly, stooped to mean or unworthy methods.

F. H. WENHAM.

Francis Herbert Wenham was one of the most notable and original workers in applied science of the past century. Passing over as too numerous for detailed enumeration his many mechanical inventions, we may record his introduction of the single front in microscopic objective, when he introduced thickness as an element in obtaining proper correction of an objective. Mr. Wenham was the first to devise the oil-immersion microscopic objective, which has since been brought to perfection by the late Prof. Abbe. At a meeting of the Royal Microscopical Society he actually showed an objective which he termed a homogeneous lens, i.e., a lens attached to a threefold objective with the cover glass of the object kept in contact with this front lens by means of cedar oil. Mr. Wenham showed the test object *angulatum* brilliantly defined by this oil-immersion objective, but, unfortunately, he did not at the time realise the great importance of the oil immersion system in the matter of yielding greatly increased numerical aperture.

In 1870 Mr. Wenham became scientific adviser to the firm of Ross and Co., in which capacity he made many improvements in the microscopes and accessories produced by that firm. His connection with Ross will perhaps be best remembered by his introduction of the once well-known "Portable Symmetrical" lenses. These lenses were an adaptation of Grubb's well-known landscape lenses, produced by reducing the large diameters, combining the lenses as doublets, and by using thickness as an element in their correction, thus obtaining diaphragms in close contact with the lens and giving greater angle of view. These lenses were produced in a series of ten, all fitting the same flange, and became exceedingly popular with landscape photographers; in fact, they entirely displaced the old single lenses of that period.

JOHN A. HODGES.

Another well-known worker in the photographic world has passed away in the person of Mr. John A. Hodges, whose death took place at the early age of forty-six. Mr. Hodges was an enthusiastic and active photographic worker, and his writings, both in article and book form, bore the stamp of emanating from one thoroughly acquainted with his subject. He was also one of the

most able exponents of the pictorial lantern-slide, of which he possessed a large collection, illustrating the most beautiful portions of English and Welsh scenery. Mr. Hodges for some years discharged the duties of hon. secretary of the Royal Photographic Society, and was a constant exhibitor at its exhibitions.

H. S. MENDELSSOHN.

Mr. Hayman Selig Mendelssohn was born in Germany, but his youth was spent in Poland. In his early manhood political reasons obliged him to leave that country, and he settled at Newcastle-on-Tyne, where he commenced his photographic career. After serving with Mr. D. Downey for some time, he went into business for himself, and was so successful that he found it advisable to take advantage of the wider scope for ability that London affords, and removed his business there about twenty years ago. In a brief space of time he established a reputation which stood until his death.

Mr. Mendelssohn joined the Royal Photographic Society in 1884, and was an original member of the Professional Photographers' Association.

Among others whose deaths have taken place during the past year are :—A. S. Spratt, of Messrs. Houghton's, Limited; Captain Henry Lomb, one of the original partners of the Bausch and Lomb Optical Works; J. Hort Player, inventor of the curious process which bore his name; William Mayland, a father of professional photography and contemporary of England and H. P. Robinson; Dr. Janssen; W. D. Valentine, of Dundee; Percy Eland Newstead, known under his pen-name of "Peter Eland"; Thomas Taylor, president of the Birmingham Photographic Society; and Professor Von Jan, of Strassburg.

REFLEX CAMERAS.

BY THE EDITOR.

NO recent change in the manufacture of hand-cameras has been so marked as the adoption of the reflex principle by almost every maker. At an exhibition of reflex cameras held at the offices of "The British Journal of Photography" in the summer of 1907 there were shown at least twenty-five different patterns or makes of camera, and, as testified by the pages of the "Almanac" for the last and the present year, the list has since been swollen by several additions. The reason for this widespread favour accorded to the reflector principle is clear enough—the reflex camera at its best practically equals the stand-camera in certainty and movements, while it attains its results with infinitely greater rapidity. It combines the handiness of the hand-camera with the series of facilities regarded as the prerogative of the elaborate field-camera. Advisedly, one makes this claim for the reflex *at its best*, for reflexes, as other cameras, are of different degrees of merit, and the particular usefulness of a movement possessed by one or another must be judged not only in reference to the user's own requirement, but with a knowledge of the somewhat different conditions of reflex work. This article may therefore commence with a brief enumeration of the advantages which a really good reflex should impart, and the reader may thus see for himself the utility or otherwise of movements available in the commercial instruments.

THE REFLEX PREVENTS BLANK EXPOSURES.

The first point to mention, though it bears indirectly only on the quality of hand-camera work done with a reflex, is the impossibility of inadvertently making an "exposure" with the lens covered—an act of absent-mindedness or haste of which the user of an ordinary finder camera is bound to be occasionally guilty. The mirror automatically puts things right in this respect at the start, and leaves the user to look only after the setting of the shutter and the uncovering of the plate or film. In certain makes of camera this check upon the user is carried further by the provision of a blocking mechanism whereby the shutter cannot be re-wound after

an exposure until the mirror has been depressed. Thus, while this feature of the reflex is not a positive facility, it is a valuable auxiliary, as it leaves the hand-camera user with one or two fewer things to think about, with the result of a higher percentage of effective exposures.

THE CERTAINTY OF FOCUSING BY REFLECTOR.

But it is in the ease of focussing and arranging the subject on the ground glass that the power of the reflex is most fully in evidence. One might almost have assumed that there was no need to emphasise these properties of the reflex type of camera, yet, so hard do custom and prejudice die, that it is not uncommon to meet hand-camera workers who will not concede any advantage to the full-size focussing over the methods of scale-focussing based on judgment of the distance of the subject. Granted that after a somewhat lengthy course of practice a high degree of skill in judging distance is attained, it is extremely rare to find it very wide in its scope; it is usually confined to a certain class of subject, and as soon as a subject in different surroundings is approached the power of accurate judgment of distance falls off, and may lead the worker astray. This fact is generally recognised by expert hand-camera workers.

Then again, although such skill in distance-judging may be attained as to ensure fairly certain work at the average distances of 10, 15, and more feet up to an infinity of 50 or 100 ft. in the case of a lens of about 5 in. working at $f/6$, the power attainable by ordinary beings is totally insufficient in the two distinct conditions of (a) photographing objects nearer than, say, 6 ft., and (b) using a lens of large aperture or extra-long focus. The first of these two conditions is not so common as the second, but is nevertheless no imaginary case. In the ordinary run of tourist photography many interesting objects, tablets, bits of ornament, etc., are met with which are beyond the powers of the ordinary hand-camera (unless converted for the nonce into a stand instrument) but yield immediately to the reflex.

THE REFLEX, FOR LARGE-APERTURE OR LONG-FOCUS LENSES.

In regard to the tax which the modern large aperture lens lays on the skill of the hand-camera worker, it must be remembered that the judgment of distance must be increasingly exact as the lens aperture is increased, or a lens of greater focal length employed. A glance at any table of "depth of focus" will show the narrower limits within which accurate focus is obtained, and yet—and here is the point of importance—modern hand-camera work involves both these limiting factors. Our improved æsthetic standards will have none of the semi-exposed negatives which passed muster in the past (need of large aperture), nor of the wide angle given by the lens of "normal" focus (need of long focus). These are the views of the pictorialists; the non-artistic public is even more exacting in its demands for photographs of events, social, sporting, and what not, the photography of which necessitates extremes in the use of large aperture and long focus lenses. The only way to successful work

in these conditions is found in the reflex camera. To give but one example of the everyday application of the methods just referred to, I may quote Mr. Arthur Marshall, who, in a volume of travel entirely illustrated by himself, and entitled "Three Vagabonds in Friesland," describes his methods of tourist photography at the rate of about fifty plates per day with a reflex camera. Writing of the 5 by 4 size, he says:—"A useful though costly accessory to this camera is a first-class 12-in. focus lens working at about $f/6$. Many of the pictures in this book were taken with this lens. Of course, the single combination of the smaller lens gives an image as large, but the rapidity of the larger lens is useful in cases where the other would be useless."

THE INCREASED OUTPUT OF A REFLEX.

The previous paragraphs show just where the reflex surpasses cameras of the scale-focussing pattern. In comparison with a stand camera the reflex scores in another way—that of quickness in dealing with a subject. A minute or two's work will show the photographer the comparative merits of a dozen different points of view, in circumstances where a stand-camera would very likely involve half-an-hour's work. To this it may be said that the photographer should judge his view point by his eye alone, but that advice—excellent as it is—leaves out of account the fact that, usually, the camera is used at a lower level than the eye, and unless care be taken to stoop to the level at which the lens will be used, the result on the focussing screen is often found to be disappointing, owing to some object in the distance coming awkwardly against a part of the foreground. The reflex camera shows us the scene exactly as it will be photographed, and thus prevents this want of correspondence between what is seen and what is hoped for on the plate, and this certainly is secured, as I say, as quickly as with the eye alone. Not only this, but there is a further advantage, appealing chiefly to the pictorial worker, in regard to which I may again quote Mr. Arthur Marshall, all of whose delightful exhibition work owes its creation to a reflex.

THE "PHOTOGRAPHIC QUALITY" OF THE PICTURE SEEN IN THE REFLEX.

Apart from the importance of being able to judge better of grouping, lighting, etc., when inspecting a full-size reflected image, Mr. Marshall insists on the more faithful rendering of a scene obtained when seen on a ground-glass screen, in comparison with the "prettily" bright image of the "brilliant" type of finder. Writes Mr. Marshall*:—"The quality in a subject which one might call 'photographic' is better appreciated and more easily judged by the appearance of the image upon the ground-glass of a reflex than through the ordinary brilliant finder—to my mind a most important point, as the photographer is frequently led astray by the prettiness of a subject when seen through the ordinary finder, and as frequently disappointed with the result of the exposure. The nearer

* "The British Journal of Photography," June 21, 1907, p. 460.

the relation of tones in a subject the more capable is it of a good photographic rendering. In no other hand-camera, however, is it possible to ascertain the value of this tone relationship by means of the finder."

CAMERA "MOVEMENTS" ON A REFLEX.

The usefulness of adjustments, such as rise and swing of front, are largely discounted in a scale-focussing camera by the fact that the worker can only guess, from previous use, what their effect will be, whereas when employed on a reflex camera, he can actually see what he is doing. A moderate rise of front is about all the adjustment which a scale-focussing camera, to be used exclusively in the hand, may advantageously have, but a reflex can do with all the movements which can be given to it without sacrificing its convenience and quickness in use. The most important of these undoubtedly is a rise of front.

RISE OF FRONT.

No other device for the purpose of showing the picture obtained on the plate when the lens is raised can be compared for certainty and simplicity with the reflex camera. As to the range of movement which is desirable, a useful limit is a rise equal to one-quarter or one-third the vertical height of the plate in the case of the normal angle of view (of about 56°), represented by the use of a five-inch lens on a quarter-plate. If the reflex will not take as short a focus lens as this, then the available rise of front to secure the same result must be proportionately greater. Exceptional subjects require more—frequently, much more—movement than the above, but the worker will find the above a useful medium between the extreme rise possible only by greatly increased bulk or a special front, and the really insufficient upward movement provided by many cameras. In using a reflex (fitted with a rise equal to one-quarter the height of the plate) among the old cities of Germany, such as Nürnberg, it was not once in fifty times that tall buildings could not be obtained on the plate except by tilting the camera.

Incredible as it may sound, we are sometimes assured that a hand-camera is none the worse for the lack of a rising front. You tilt the camera, and in making a reproduced negative, enlargement, or lantern-slide, you correct the convergence of the lines. Apart from the trouble of these operations, there is great danger of dwarfing the subject, even though the lines are parallelised, a fact which does not appear to be generally recognised even by champions of the reduction of the hand-camera to the simplest elements. As Mr. Welborne Piper has shown, proper correction of false drawing, due to tilting the camera, involves some very complex considerations, and the only simple, practical method necessitates the enlargement of the image on a scale of at least 2:1. The reader should consult the formulæ given under "Correction of Convergent Distortion" among the "Optical" calculations in the latter portion of this "Almanac." The use of other movements, such as swing front and back, is referred to in a later paragraph.

THE REFLEX AS EXPOSURE GUIDE.

I quoted Mr. Arthur Marshall just now in the matter of the forecaste which the reflected ground-glass image provides of the photographic effect of a scene, and now I must reproduce another item of Mr. Marshall's practice—the gauging of exposure from the brightness of the ground-glass image—albeit that I cannot declare myself an adherent to it as a substitute for the exposure-meter.

"It is astonishing," writes Mr. Marshall,* "how easily the eye may become accustomed to the value of the light upon the ground-glass; by careful observation the length of exposure necessary may be easily judged also. This, again, is a most valuable feature possessed by the reflex camera, and to which there is no corresponding advantage in the other types of the hand-camera. Exposure tables may be all right as an approximate guide, but seldom have I found the subject which I was taking quite fit any of the headings so carefully worked out. Therefore, I would much rather trust to my own judgment and rely upon the appearance of the image upon the screen and expose accordingly. By means of the reflex camera this is quite possible, but with the ordinary type it is not."

HIGH AND LOW POINT OF VIEW—REFLEX WORK.

One objection alleged against the reflex is that, owing to its construction, it must be used from a lower point of view than is often desirable on account of the exaggerating effect which such a lower point has on the height of buildings in the foreground. It is certainly true that a fairly high view-point is desirable—even necessary, as when photographing from behind a fence or line of people. On the other hand, a low standpoint is far better for figures and other near objects. However, it must be said first, that at least two patterns of reflex on the market provide for use at the eye-level by means of a mirror in the hood fixed at an angle of about 45° to the ground-glass. The image in the latter is thus reflected, and gives the photographer an inverted and partial but nevertheless usable picture, which serves as a complete guide to proper focus, and as a sufficiently good guide to the composition of the picture on the plate. Secondly, so far as focussing is concerned, this operation may be done at the lower level, the camera then raised to the eyes, and the selection of the field made by judgment with the eye, and it will be found possible with practice to use the ordinary reflex with great certainty in this way, as the chief difficulty—the focussing—does not enter into the case. In fact, the method is precisely that most commonly adopted by photographers of sporting and other events in which rapid movement occurs. With the best apparatus it is usual in the case of such subjects first to get the camera in focus on a certain spot, where the moving figure will come, but at the time of the actual exposure to keep the eyes fixed on the subject itself, not on any image of it in a finder. The camera is best at the level of the eyes for this to be done, and a reflex camera is quite as suitable as any other for such work. Or the reflex can be used at eye level, when required, by dispensing with the mirror movement, employing a

* "The British Journal of Photography," June 21, 1907, p. 460.

focussing screen directly opposite the lens on which to focus (the mirror being raised), then placing the dark-slide in position, and giving an exposure by inspection of the subject itself.

There is furthermore the method employed by some users of the reflex camera, more particularly for press work, of holding the instrument upside down at arm's length (the hands almost vertically above the head), and viewing the image through the downward hanging hood.

Where a support—*e.g.*, the top of a fence if not of a tripod—can be had, the camera can be laid on its side, and thus used at a height which would be incompatible with the comfortable examination of the focussing screen in its ordinary horizontal position. Not all cameras will allow of this being done owing to the projection of release-knobs, winding keys, or focussing pinions, but where shutter release and focussing are arranged on the same side of the camera, as they are in some instances, advantage can usually be taken of this device, which often provides the way out of a difficulty.

INSTANTANEITY OF ACTION IN PHOTOGRAPHY OF MOVING OBJECTS.

This brings us to one other point in connection with the photography of objects in rapid motion—namely, the relative instantaneity of action of the reflex camera and of the ordinary focal-plane shutter such as the Goerz-Anschutz, which may be taken as the standard type of the folding focal-plane camera. Does the reflex respond instantaneously to the release in exposures of objects approaching the camera or moving across its line of sight at high speed? The question, by whomsoever put, amounts to a confession of inexperience in high-speed photography, for the reason that the personal equation enters into all such work when making the exposure, and the practised operator will mentally anticipate the arrival of the oncoming runner or cyclist in order that the exposure may actually take place when the latter has reached the pre-determined point. In the case of a reflex the interval between pressure on the release and the exposure is probably always a little longer, but the adjustment lies in the automatic anticipation of the point at which the release is made, a point which may be observed when watching the object itself or its image on the ground-glass of the reflex.

FIGURE STUDY WORK.

When using the reflex fairly close to figures and small groups the more conspicuous nature of the hood may be a drawback unless ways and means are used to conceal it from the subjects. Obviously, nobody in his senses would go about with his eyes glued to the mouth of the hood and still expect to get snapshots of figures unconscious of his presence, any more than he would anticipate the same result if he kept a box camera similarly pointed towards his subjects. The reflex, like the scale-focus camera, requires to be kept set at focus for a given distance (which can easily be adjusted by focussing on an object equidistant in the opposite direction, whilst standing with one's back to the subject proper), to be brought

quickly into position, one rapid lock taken at the image and the shutter released. Thus used, the reflex is certainly as efficient in "scouting" figure studies as the box or folding pattern of camera, while it has the advantage over the former that the surroundings (foreground and background) can be arranged and studied on the focussing screen before an expected figure arrives. An exact spot can be focussed upon, and the relative disposition of the planes of sharp and diffused focus thus foreseen before an exposure is made.

Another dodge which can be used with much success with a reflex is to stand with the back to the subject, the camera being thrust under the arm. On looking into the hood an image (inverted) is seen, and, with a little practice, may be focussed almost as well as when working in the usual way.

A FRONT REFLECTOR FOR SIDEWAY SNAPSHOTS.

However, the reflector principle provides a most efficient and simple method of securing photographs under the very noses of the subjects, yet quite unsuspected by them. It consists simply in the attachment to the front of the lens of a mirror placed at an angle of 45° to the axis of the lens. One of the earliest if not the earliest user of this device was the late Mr. A. M. Geddis, of Dublin, the arrangement of whose camera was described in an article by Mr. W. Kilbey, in "The Photogram," 1902, pp. 227 and 261. Mr. Geddis fixed the mirror to the hinged front door of the camera, which was kept open at the angle of 45° by a strut. An arrangement more convenient for the modern reflex camera is that of Messrs. Adams and Co., viz., a framework which can be quickly attached to the camera front, and can be carried flat when not in use. When using this front mirror the camera is pointed forwards, but the photograph actually represents objects sharply to the left or right. The negatives obtained are reversed as regards right and left, although that is often of small moment, except the negative is one of a familiar scene, or one in which lettering appears, and even then an unreversed enlargement or lantern-slide is just as easily made or a contact print taken in single-transfer carbon. It should be added that as the mirror actually forms the image on the plate its surface needs to be optically flat.

ESSENTIALS OF A REFLEX CAMERA.

We now come to the most important part of this article. In the foregoing paragraphs I have emphasised the many and various advantages of the reflector type of camera. A word of caution must now be uttered as to the conditions under which these advantages are realised to the full. Expressed in a few words the advantages of a reflex are:—

(1) Great accuracy of selection of the subject on the ground-glass.

(2) Great accuracy in focussing (even with large aperture lens)—again on the ground-glass.

(3) Great accuracy in selection and focus when using a long-focus lens—but still again on the ground-glass.

Obviously all these adjustments are of indifferent value unless the effect seen on the focussing screen is reproduced on the plate, and also—almost equally important—unless special tools, such as lenses of long focus or large aperture, can be quickly got into use and properly employed. In other words, I query the good of being able to adjust the tip of a spire on the ground-glass so that it comes, just as it should, one-eighth of an inch below the top edge of the picture if want of adjustment in the dark-slide or in the reversing back which carries it makes havoc of the careful placing. One queries the good of being able to focus with an $f/4.5$ anastigmat unless the plate is in accurate focal register with the ground-glass, and unless the lens, as necessary for most instruments of this class, can be screened from strong direct light. Again, the facility of obtaining accurate selection and focus when using a lens of long focus is heavily discounted if the bringing of the long-focus lens into action is a lengthy process, and requires much fiddling about with screwed flanges. Therefore—and this is the point I would impress upon the prospective purchaser of a reflex—it is not enough to assume that the reflector principle pure and simple will do everything which may be imagined of it. Construction and adjustment of a very accurate kind are necessary to ensure exact coincidence of effect in focussing screen and plate, and the highest skill of the camera-maker can be profitably expended on other movements which shall give ease and rapidity to their action. In short, the reflex, like other cameras, depends upon excellent design and first rate workmanship—the one as much as the other—for its ready and efficient execution of the principle upon which it is based. This point requires to be kept clearly before the reader, who is choosing a reflector camera, in deciding as to the usefulness of the adjustments offered in a reflex. These latter may now be considered in order.

WHAT SIZE OF REFLEX CAMERA.

The only size of reflex which I have had in regular and everyday use is the quarter plate. I have had others—from the quite small sizes up to the bulky half-plates—in occasional use, but still for regular outdoor work, for taking on a tour, or for going about I cannot conceive of anything larger than quarter-plate being adopted. Half-plate may be put aside at once as solely for professional, Press, and other business purposes. Its size and weight are frightful, but its advantage for commercial work is that in very many cases its work can be used unenlarged. The same may perhaps be said of the 5 by 4, the smallest size which is of much use in the form of contact prints. The price of a 5 by 4 compares fairly favourably with quarter-plate—it is not very much more—but in size and weight it is usually at least half as heavy again, and the same ratio applies to the weight and cost of plates. For lantern-slide purposes 5 by 4 is not as suitable as quarter-plate, and for enlarging there is really nothing to choose between the two. If contact prints only are to be made, there is certainly a distinct advantage in the 5 by 4. Yet, on the whole, quarter-plate is the best size for the amateur worker. I say this in regard

to what can be bought, at any price, from the regular makers; yet while coming to this conclusion I cannot refrain from stating the preference which I believe I should feel for a reflex of the $3\frac{1}{2}$ by $2\frac{1}{2}$ size. A camera of this size is made at present by several makers, though not in all cases with the full range of movements possessed by the standard size instruments. The $3\frac{1}{2}$ by $2\frac{1}{2}$ size, however, appears to me to be worth consideration, for the reason that while negatives taken in it at the normal view angle of about 56° will enlarge to a given size quite as well as quarter-plates, the $3\frac{1}{2}$ by $2\frac{1}{2}$ plate gives negatives which in most cases can be printed as lantern slides by contact. A quarter-plate negative properly composed, as it easily can be, in the reflex, almost invariably requires reduction when slide-making. The rather haphazard negatives (quarter-plate) obtained with finders will usually do with a fair amount of trimming down of the subject, so that very often a 3 by $2\frac{1}{2}$ picture is as much as one wants out of them, but the very fact that the spacing of the subject is so much better in the reflex negative actually makes one half repent the nicety of adjustment, inasmuch as it compels one to make the slide by reduction in the camera. However, as a $3\frac{1}{2}$ by $2\frac{1}{2}$ camera of the requisite movements would apparently bulk and cost just as much as a quarter-plate, it is easy to understand that there is little commercial inducement to introduce it.

SINGLE AND DOUBLE EXTENSION.

Most makers rightly draw attention to the advantage of a double extension; or of one long enough to take the half of a doublet lens, which, in the case of some of the modern anastigmats, gives a perfect single lens of $f/12$ or even $f/9$ aperture. But few makers pay the same regard to the equally important point of rapidly changing to the double focus position. The front lens has to be removed from the doublet, and the camera front quickly extended. If these two things can be done easily and quickly while one is walking along, and scarcely looking at the camera, it is certain that much greater use will be made of the movement. Your photo-chemists talk of the "inertia" of a dry-plate, but camera-makers have to consider the inertia of the human person, and to bridge the gap between the intention to see what such and such looks like on the focussing-screen with the double focus and its actual appearance there. Therefore, special mounting of the front lens, to facilitate its instant removal, and provision in the camera of a receptacle for it whilst out of use are soon found to be no "fancy" features, but really practical aids. As regards the extension movement, I do not grumble at having to rack all the way from single to double extension, as must be done with some cameras. A draw-out base-board, which at its double extension is actuated by the same piece of rack, is probably only a very little quicker, though much to be preferred on account of the lesser amount of wear which it entails.

Extension to double the focal length of the lens, it should be added, is of service for other purposes than the use of the single component. It permits of copying being done to same size quite

easily with the camera held in the hand, an operation which, even with a stand camera, is a rather tedious business, but in the case of light subjects, where a fifth or a tenth of a second is sufficient exposure, is done most expeditiously with a reflex held in the hand.

To some extent the need of a long extension is diminished by the recent introduction of fixed focus telephoto lenses of the relatively large aperture of $f/9$, which is a further facility of the kind provided by the "Adon." A camera extension of about 6 or 7 in. thus serves for the narrow angle (long focus) views of distant and medium-distant objects, whilst for copying same size an anastigmat of short focus ($3\frac{1}{2}$ to 4 in.) may be carried. Yet this system sacrifices one great advantage of the reflex—the use of a large-aperture long-focus lens.

THE SHORTEST FOCAL LENGTH OF LENS.

Of less, but still of some importance, is the question of how short a focal length of lens a reflex camera will accommodate. A moment's consideration of the internal mechanism of the camera will show that the upward swing of the mirror necessarily fixes the distance at which the lens mount shall be from the plate. Almost any quarter-plate reflex will allow of a 6-in. focus lens being used; a good many will take a 5-in. lens, and one or two, perhaps one a shade under this. As a general rule one will wish to be able to use a 5-in. lens, otherwise there will be many occasions on which too little of a subject is included on the plate. The necessary clearance of the inwardly projecting lens tube by the mirror is obtained in various ways. The mirror may be made with a strip about three-quarters of an inch wide hinged to the main portion. The hinged strip

hangs thus



in its passage upwards, and avoids contact with the lens mount. A rigid mirror, having an "in-and-out" movement, which "dodges" the lens mount, is another quite practical method, though no such expedients as these allow of a really wide-angle lens, say 4 ins. on a quarter or 5 by 4 plate being used. The use of such a lens in a reflex has been declared an impossibility, but the problem has recently been simply and very ingeniously solved by Mr. A. L. Adams, who has patented the system of moving the mirror not upwards, to lie against the top of the camera, but downwards, to lie on the bottom of the camera. With a wide-angle lens there is not room for the mirror to cross between the mount and the plate. Very well, we cause it to move the opposite way, and provide other means for covering the ground glass before the plate is uncovered. This Mr. Adams does by means of a flexible blind, and the device, as I have had an opportunity of inspecting it in a working model, certainly works satisfactorily, although a camera of this kind is not likely to be so largely in demand that it can be issued at a price comparable with stock patterns of instrument.

FOCUSING SCREEN AND HOOD.

Some skill has to be expended on the making of a hood which gives an uninterrupted view of the entire ground glass, while still

retaining a height when erected of 8 or 9 in., which is the best average distance of the eyes from the screen. For obvious reasons the focussing screen is square, and marked with the "upright" and "landscapewise" positions of the plate which the camera is made to take. It is, therefore, essential that the whole area of the screen, with the exception of the very corners, should be clearly discernible. Another equally important point is that the focussing screen shall be readily uncovered to permit of dusting or wiping. If the ground glass becomes wet, as it can hardly avoid doing when one is working in the rain, it will be found practically impossible to focus properly, owing to the refraction caused by drops of water on the screen. I recall one occasion when a day's photography was done in an almost incessant rain, and the focussing screen had to be wiped every few minutes, despite care being taken to shield the mouth of the hood. In such circumstances access to the screen needs to be an operation of a few seconds only, and is really more essential to the effective use of the camera than access to the mirror, since this latter can usually be depended upon to be in working order if dusted (with a soft brush or handkerchief) when starting work in the morning.

As regards the use of focussing magnifiers in the mouth of the hood, my own preference is to dispense with them, but opinions differ greatly on this point. Far-sighted persons can evidently profit by employing them, whilst for critical work, and particularly when using the telephoto lens, a single eye-piece or a pair of magnifiers is a necessary addition to the outfit.

THE MIRROR.

A surface-silvered mirror is, of course, a necessity if the worker is to rely on absence of confused outlines (due to reflection from the front surface of the glass), which will be particularly noticeable in the case of brilliantly-lit subjects having masses of shadow. However, surface silvering may be taken as a general desideratum.

The mechanical adjustment of the mirror, the balancing of the springs which raise it with the minimum of vibration or sound are beyond the province of the present article. A camera must be judged on its merits in these important respects. None can be said to be absolutely silent, whilst as regards vibration it must be admitted that the release in rapid succession of a mirror and focal-plane shutter is accomplished by several instruments with a remarkable freedom from jar.

In connection with the mirror one point, not a great one, perhaps, but still of value, may be mentioned, and that is the indication on the outside of the camera as to whether the mirror is "down" or "up"—that is, set or requiring setting. Cameras in which the mirror automatically falls again after exposure of the plate do not possess, nor require, such external indication. In the case of others it is useful to have it, since it is a warning against winding or re-winding the shutter, and so uncovering a plate or film which may be otherwise unshielded. The position of the setting lever in several cameras serves this purpose.

THE SHUTTER.

With scarcely an exception, the shutter of the reflex camera is of the focal-plane type—that is, of the maximum “efficiency,” and affording a range of exposures which no other pattern of shutter can equal. It is unnecessary here for me to enter upon the varieties of these shutters, but I may advise the reader to resist the fascination which appears to be exerted by the offer (in a shutter) of a tremendous variety of speeds, the “one-fifth to one-thousandth” of the makers’ lists. I do not say such a range is not desirable or not attained, but I do say that much more desirable is it to have the real practical convenience of being able to alter the speed within a small range only at the moment before exposure. In sober fact, it is once in a thousand times that one wants to change the speed suddenly from a twenty-fifth to an eight-hundredth, but it happens very often indeed that one wishes to alter the speed from a twenty-fifth to a tenth or a fiftieth. All cameras allow of this being done, but not all while the shutter is set, and fewer still quickly and in such a way that it is hardly necessary to take the eyes off the focussing screen. In the case of a number of cheaper patterns of camera the time taken to make the change is so long that rather than risk losing a subject the photographer will let it go at the set speed, though he knows that a change in the light or the appearance of a more rapidly moving object has made a change advisable. It is in such respects just as in the use of the camera at the double extension that some of the differences between the high-priced instruments and the cheaper varieties are discoverable.

As regards time exposures, I must confess that my own preference is to dispense with both mirror and focal-plane shutter, releasing the mirror into the “up” position, opening the slit of the shutter to the full width of the plate, and using a cap or lens shutter for the exposure. Makers provide for exposure both with and without the aid of the mirror, yet when it is so easy to avoid any possible vibration it certainly seems best to adopt the safest plan.

INTERGEARING OF SHUTTER AND MIRROR.

An advantage, which, from its construction, is peculiar to the reflex camera, lies in the connection of shutter and mirror, by which:—

- (1) The shutter cannot be wound while the mirror is up, or
- (2) The mirror always falls again after an exposure, unless purposely latched up, or
- (3) The shutter can be wound but not kept up if the winding-key is turned while the mirror is up, thus exposing the plate.

The last-named tells us at once that the mischief has been done, which is something, though not so good a movement as No. 1 or No. 2, of which we prefer No. 1 for the reason that on this system it is apparently easier to provide a gentle release than it is on No. 2, in which, in the commercial patterns, the setting lever for the mirror acts also as the release.

FOCussING PINION AND SHUTTER RELEASE.

A point in regard to which there is much difference of opinion is the disposition of the focussing screw in relation to the shutter release. In some cameras these are placed on opposite sides; in others, near together on the same side. The first system is adopted in order to focus a moving object up to the instant of exposure, following it on the ground glass with the focussing screw, and keeping the finger of the other hand upon the release. In the second system the left hand is given the duty of holding the camera firmly, and the right that of focussing the subject and releasing the shutter, on the principle that the most accurate work is done, in the case of rapidly moving objects, by first focussing on a point in the stationary portion of the view, and waiting until the object just reaches it before making the exposure. I must say that so far as my own experience and that of others whom I have known to be practised users of a reflex has gone, this latter method is the practical one. The ability to focus (with one hand) on an object rapidly advancing towards you, to release (with the other hand) the shutter immediately, and meanwhile to be holding the camera firmly, calls for some sixth sense, which is the possession of the few. As in press work with folding cameras, the best course consists in focussing upon a spot and waiting for the object to arrive at it, the special advantage of the reflex being that one *can* actually focus on the spot, and can also see by a preliminary observation of a similar object just how large the image will be in the negative.

THE REVERSING, OR ROTATING, BACK.

The reflex camera not readily admitting of being turned on its side for use, must either be built square and provided with a reversing back, or the use of the mirror dispensed with when the camera is used in the sideways position. Except with a view to reduce the size to the very minimum, the square construction is rarely departed from, and the reversible back then takes one of two forms, the loose frame, as customary in stand cameras, or a back which is permanently fixed to a circular rotating turntable attached to the camera body. This latter form is certainly to be preferred, even though a somewhat solid construction is necessary to ensure its satisfactory working. It should be provided with accurately placed catches to automatically arrest it in one or other position. In regard to backs of the rotating type, the only point, in addition to thorough workmanship, is whether the shutter is best placed on the back or on the fixed camera body. The latter position has the advantage that the winding key and speed indicator are then always in the same place, though after a time one soon gets accustomed to turn at once to the alternative position which they occupy when the shutter is carried in the rotating back. The latter, as the carrier of the shutter, has the advantage that it is, or should be, easier to make the shutter-blind work very close to the plate, a slight gain in "efficiency" of exposure, and also something can be done in the way of making the slit in its passage across the plate meet the image of a rapidly moving object instead of running

across the image in a direction at right angles to the motion, an adjustment which is sometimes advisable with a view to prevent possible distortion of a rapidly moving object by the focal-plane shutter. Yet neither of these arguments is of much weight, and it can be taken that the placing of the shutter in one place or the other is really dependent on other and more important features of the construction.

RISING AND SWING FRONT.

I have already referred to the necessity of ample provision in the way of rise of front. It is due to the reflex and to the accuracy with which the effect of rise is seen to provide a displacement of at least one-quarter or one-third the vertical height of the plate. More than this, the "nicety" with which the subject can be arranged on the focussing screen almost makes a screw or a rack adjustment of the front obligatory on the part of the maker, and the leading makes of camera possess it; again, an apparently minor point, but one which greatly aids rapidity and certainty in working. It is difficult to see the usefulness of a cross-front movement, sometimes found on cameras even of square build.

As regards the use of the swing front, I may quote Mr. H. G. Ponting, F.R.G.S., who, writing from Yokohama to "The British Journal of Photography" of September 8, 1906, says:—"Apart from the value of this movement in architectural work—for the effect of swinging the lens is exactly the same as swinging the back—let me point out its untold value in ordinary instantaneous work, or in press photography. Naturally, you always try to get a little elevation if you can (on, let us say, such an occasion as some public event in the streets), both to secure better perspective and to get above the heads of the crowd; and, given such a slight elevation, the man whose reflex is provided with a swing front can completely eclipse the efforts of his confrère whose camera is not so fitted. Perhaps the weather is bad and the chief subject moving rapidly; the use of a small aperture is impossible, yet with a large stop only a portion of the picture can be got into focus. Now just tilt the lens out at the top a bit—i.e., tilted, looking downwards, and instantly even at the full aperture of the lens (if the focus be not too great), say, a 7-in. at $f/4.5$, the whole field of view, from the heads of the people immediately below you to furthest infinity, comes into sharp and clear focus, and the effect, as you see it on the ground glass in the top of the camera, corresponds exactly with that on the plate. By this simple device the man whose lens is not faster than $f/8$ can secure a result beyond the power of the other man, no matter how rapid his lens, if his camera front be rigid, for in order to secure a corresponding depth of focus the latter would have to stop down to $f/16$ or $f/22$." Mr. Ponting writes as a press photographer and war correspondent of large experience, and his work, since exhibited in England, has proved the soundness of his methods. The example he cites is only one of numerous others where a swing-front or a swing-back renders good service. Such movements, however, are obtainable only on a few cameras. A single swing-front is fitted to the "Soho" camera. Messrs.

Adams have devised a simple swing-front panel, which allows the lens to be tilted either up or down or sideways, and also to be automatically brought back to its normal position of squareness. The Thornton-Pickard Co. issue a camera fitted with a front possessing the movements of their "Ruby," and we hear of a reflex with a swing-back also making its appearance.

The purpose of these movements is to allow of foregrounds and distance occurring in different parts of the plate being focussed at the same time without the use of a small stop, an adjustment which could not be made with certainty in any hand-camera but one of the reflex type.

LENS SHADES—LEVELS.

The provision of means of shading the lens, either by a recessed mounting of the lens, by a hinged panel on the camera front, or other means, such as the recently introduced collapsible lens hood, is an adjustment which is almost essential to the use of the very large aperture lenses. It is an advantage in any case, as it does not involve any disabilities in other respects, and should certainly be considered part of a finely equipped reflex camera.

The level calls for no special remark except that care should be given to place it where it can be seen in one quick glance of the eyes from the focussing screen. A position near to the base of the hood is as convenient as any.

The suggestion has been made by Mr. F. M. Sutcliffe* to place the level under the ground glass, employing for this purpose a circular level with glass top and bottom. Except for the obliteration of part of the image, the plan seems a practical one.

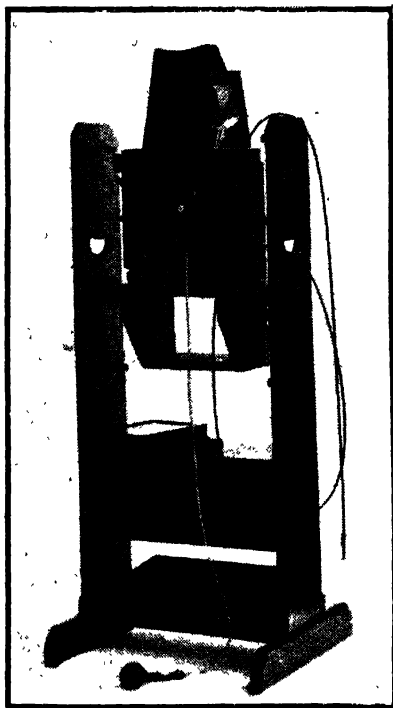
THE REFLEX IN STUDIO PORTRAITURE.

The limits within which a sitter must be kept in order to secure sharpness in the negative being comparatively narrow, it is obvious that the reflex should enable the portrait photographer to secure poses in great variety without worrying the sitter by requests to "keep so," until the exposure is made. That excellent use is thus made of the reflex by professional workers is proved by the experience of Mr. Gordon Chaset, who has used it largely for portraiture of children. Mr. Chase recommends the use of the camera on a stand such as that (of his design) shown in the illustration which allows of the camera being brought within sixteen inches of the ground, a low position, often advisable when taking full-length portraits of little children, being also the most convenient for the use of the reflex. For the sake of silent working, Mr. Chase uses a pneumatic lens-shutter for time exposures, reserving the focal-plane shutter for instantaneous exposures. The lens shutter, shown in the drawing, also acts as a shade. When using it for time, the focal-plane shutter is set at time, the blind wound up half-way to

* "The British Journal of Photography," June 28, 1907, p. 494.

| "The British Journal of Photography," June 14, 1907, p. 439.

leave opening opposite plate and the velvet shutter closed. The "Antinous" release is pressed and the mirror rises without affecting the focal-plane blind, and leaves the plate ready for exposing. At this stage the camera is the same as an ordinary one being exposed by ball and tube, and any exposure can be given. The shutter is actuated by an "Antinous" release 8 ft. in length, which allows the photographer to be close to his sitter when exposing, instead of remaining by the camera and having a second person to make



the exposure. In the case of an "Antinous" release of this great length it is found necessary to pass it through one or other of several small holes in the side of the stand, otherwise its weight causes it to kink and bend close to the bayonet point and prevents it working.

The shelf supporting the camera is made to tilt, and so provides for a more rapid means of dealing with low subjects, such as

children on the floor, and is equally good when there are no perpendicular lines in the background. Moreover, the effect, Mr. Chase finds, is more pleasing and natural than when bringing down the camera to a very low standpoint.

Mr. Chase concludes :—"If I were asked what were the chief advantages of the reflex camera from the professional photographer's point of view, I should say, first, and most important of all, rapidity. One keeps one's hand on the focussing knob and the other holds the 'Antinous' release, and I cannot imagine a more rapid transition from a fleeting pose or expression to its fixation on the photographic plate. Secondly, portability, compared with the ordinary studio model. The reflex is certainly very much lighter and more convenient, and it disposes of that bane of the professional studio, the focussing cloth. Thirdly, but very little experience is needed to convince the user of the reflex camera of the enormous facility which it affords as regards focussing. Scarcely a single child sitter comes to one's studio but what some adjustment of the plate is necessary before the final exposure is made. In the case of the ordinary camera, three movements are necessary, in the case of the reflex only a single adjustment of the focussing pinion."

It may be added that since the appearance of the above article in "The British Journal of Photography," several patterns of reflex cameras, specially designed for studio use, have been introduced. Exposure is done by a very simple raising and releasing of the mirror almost exactly on the lines of the original reflex camera patented by Thomas Sutton in 1861.*

* Eng. Pat. No. 073, 1861,

EPITOME OF PROGRESS.

In the following pages will be found classified abstracts of papers, communications, and articles describing progress in technical photography (art topics are excluded) which have appeared in the British and foreign Press during the twelve months October 20, 1907, to October 20, 1908. It may have happened that some foreign journals have not arrived in time for abstraction; their contents will be dealt with in the 1910 "Almanac."

The general arrangement of the Epitome will be seen from the contents of the "Almanac," which faces the frontispiece. Each item is separately entered in the index at the end of the volume, and a list of the journals abstracted will be found at the conclusion of the Epitome.

In a number of cases where information additional to that in the abstract has appeared in the "British Journal of Photography," a reference to issue and page has been given.

I.—GENERAL.

EVENTS OF THE YEAR.

1907.

Nov. 1 to 30, 1907.—Exhibition of photographs by artificial light at the "B.J." offices. (See "B.J.," Nov. 1, 1907, p. 824.)

1908.

Jan. 14, 1908.—Award of the R.P.S. Progress Medal for 1908 to Mr. J. Sterry "for his photo-chemical investigations, and especially for researches and writings on sensitometry and on the action of substances on the latent image." (A review of Mr. Sterry's work by Dr. C. E. K. Mees appears in "B.J.," Jan. 24, 1908, p. 61.)

Jan. 29 to April 16, 1908.—Exhibition of multiple mounted photographs by Frederick H. Evans at the Royal Photographic Society. (A review appears in "B.J.," Jan. 31, 1908, p. 87.)

Feb. 16 to March 7, 1908.—Exhibition by members of the Professional Photographer's Association. Held at the "B.J." offices.

March 10, 1908.—Exhibition of photographs by A. L. Coburn and Baron de Meyer at the Goupil Gallery. (See "B.J.," March 20, 1908, p. 218.)

March 21 to April 16, 1908.—Exhibition of photographs of the Orient by H. G. Ponting, F.R.G.S., at the house of "The British Journal of Photography." ("B.J.," March 20, 1908, p. 214.)

March 27, 1908.—Issue of a "Colonial Number" of "The British Journal of Photography."

April 8 to May 5, 1908.—Exhibition of photographs by the late Horsley Hinton at the Royal Photographic Society.

April-May.—Exhibition of oil prints at the Paris Photo-Club. A review by M. Demachy appears in "B.J.," May 1, 1908.

May 4 to 27, 1908.—Exhibition of Bromoils at the "British Journal." ("B.J.," May 8, 1908, p. 356.)

May 12, 1908.—Amalgamation of "The Amateur Photographer" with "The Photographic News," under the title "The Amateur Photographer and Photographic News," and of "Photography" with "Focus," under the title "Photography and Focus."

May 12 to June 9.—Exhibition of portraits by Furley Lewis at the Royal Photographic Society. (See "B.J.," May 22, 1908, p. 401.)

May 15 to June 8, 1908.—Twelfth exhibition of the Photo-Club de Paris.

June 1 to 27.—Second annual exhibition of the Society of Colour Photographers, held at the "British Journal" offices. (See "B.J." "Colour Photography" Supplement, June 5, 1908, p. 41.)

June to August, 1908.—Exhibition of oil prints by French and English workers at 52, Long Acre, London. (See "B.J.," June 26, 1908, p. 496.)

June 16 to July 31.—Exhibition of photographs by Walter Benington at the Royal Photographic Society. (See "B.J.," June 26, 1908, p. 496.)

July 6-11.—Twenty-third meeting of the Photographic Convention of the United Kingdom. Held at Brussels under the presidency of Sir Cecil Hertslet. The proceedings are reported in the "B.J.," July 10 and 17. The 1909 meeting will be at Canterbury under the presidency of Mr. H. Snowden Ward.

September 11 to October 24.—Sixteenth Photographic Salon at 5a, Pall Mall East. The Selecting Committee were:—J. Craig Annan, Malcolm Arbuthnot, Walter Benington, A. L. Coburn, George Davison, Robert Demachy, Frank Eugene, Heinrich Kühn, Eduard J. Steichen, Alfred Stieglitz, and Clarence H. White. ("B.J.," Sept. 18, 1908.)

September 17 to October 24.—Fifty-third exhibition of the Royal Photographic Society. ("B.J.," Sept. 18, 1908.) The Selecting and Hanging Committee (pictorial section) were:—W. R. Bland, E. T. Holding, Charles F. Inston, Furley Lewis, J. C. S. Mumery, G. A. Storey, A.R.A., and B. Gay Wilkinson. The following were the judges in the technical section at the exhibition:—Conrad Beck, C. P. Butler, A.R.C.Sc., Douglas English, M.A., C. E. Kenneth Mees, D.Sc., F.C.S., A. J. Newton, J. A. Sinclair, E. J. Wall, and Major-General J. Waterhouse, I.A.

September 28 to October 24, 1908.—Exhibition of multi-colour gum-bichromate prints by T. and O. Hofmeister and H. W. Müller at the house of the "B.J." ("B.J.," Oct. 2, 1908, p. 752.)

September 28, 1908.—Opening of an exhibition of photographs declined by the Selection Committee of the Photographic Salon at the offices of "The Amateur Photographer," 52, Long Acre, W.C. ("B.J.," Oct. 2, 1908, p. 753.)

COPYRIGHT.

Copyright in Cinematograph Films.—The judgment of Mr. Justice Jelf in the case of *Karno v. Pathé Frères* has a bearing on the possibility of obtaining copyright protection for cinematograph films under the law of dramatic copyright. Mr. Justice Jelf held that if a certain play ("The Munming Birds") had been entitled to protection under dramatic copyright, the cinematograph reproduction of it would, in fact and in law, have been a representation. It was held that such action for infringement of plays by cinematograph must be brought not against the makers of the film, but against those responsible for the representation.—"B.J.," May 8, 1908, p. 355.

Copyright Law in Germany.—An article on the revisions in German copyright law, dating from January 9, 1907, states that under the new law the use of copyright photographs is not permitted for decoration of "articles of manufacture," as it was under the previous Act, whereby even postcard publishers were enabled to make use of copyright photographs without the permission of the owners.—"B.J.," April 10, 1908, p. 279.

Rights in Unpublished Pictures.—A case which, though independent of copyright law, is of importance to those having pictures for reproduction, is that of *Mansell v. Valley Printing Company and Rankine*. The plaintiff recovered damages against a printing company which had made use of advertisement designs and photographs sold to them by an employee of the printing company without the company's knowledge that they were plaintiff's.—"B.J.," Feb. 14, 1908, p. 122.

II.—APPARATUS AND EQUIPMENT

(Including Raw Materials Used in Photography).

The many details of pieces of apparatus published chiefly in patent specifications are not abstracted in this "Epitome," as space does not permit of the numerous drawings necessary for their explanation. All patent specifications are abstracted in "The British Journal of Photography," and are entered according to subject and also under the name of the patentees in the index to the yearly volume of that publication, which is issued with the last number of the year or the first of the year following.

Dark Room and Studio.

A Dark-room Sink.—A cheap method of fitting a dark-room sink, as manufactured from cement and sand, was explained before an American convention. A framework of half-inch boards was first built on the supports where the sink was to be placed, and on this a thick layer of cement and sand in the proportions of cement 2 parts, sand 3 parts, was laid, about an inch thick. While this is setting, an inner framework of half-inch boards, about 2 in. shorter than the outer one and about an inch shallower and without any bottom, is prepared, and when the bottom layer of cement is set, this inner framework is rested on it, and the tops of the inner and other framework are kept steady at an even distance of about an inch apart by little strips of wood attached at distances at the tops. This forms a mould between the two frameworks and the bottom layer of cement, and into this mould more cement mixture is poured and allowed to set. The whole forms a most permanent form of sink at a cost of not over \$1.50 for one eight feet long. Waste pipes should be put in place before the cement is put in, and set a little below the surface of the cement to allow of shrinkage when the cement sets. To strengthen the sink, both sides, corners, etc., tenpenny nails or pieces of steel can be sunk in the sink, and, if thoroughly covered, will not rust. An old sink could be lined with cement in the same way. The cement sink showed no signs of damage from chemicals, etc., after the use of a year or more, and was thoroughly water-tight and the very cheapest possible.—"B.J." (from "The Photographer"), May 10, 1907, p. 344.

A Dark-room Blind.—W. A. Long recommends, as a convenient means of quickly darkening a room for development, the use of two blind-rollers, one about an inch longer than the other, the shorter fitted with ruby fabric and the longer with canary medium. Each blind is provided with a fairly heavy lath at the bottom. The

rollers, on their brackets, are placed in the top of the window-frame, the canary roller a little above the ruby. The vertical sides of the blinds, either or both of which may be used, are pressed against the window-frame by a pair of strips of matchboard screwed one on each side of the casement.—“Phot.,” April 21, 1908, p. 335.

Dark-room Safe-lights.—X. Jeanett and E. Manvillum have patented a dark-room safe-light of lead chromate prepared as follows:—10 c.c.s. of a 10 per cent. solution of nitrate of lead are added to an aqueous hot 10 per cent. solution of gelatine, whereupon 10 ccs. of a 10 per cent. solution of bichromate of potassium are poured drop by drop into the hot gelatinous solution of nitrate of lead which is continuously stirred. A yellow precipitate of very finely emulsified chromate of lead is thus formed. The excess of soluble salts is eliminated by washing in a similar manner as is done with the preparation of gelatine-plates. After washing, the non-actinic emulsion is heated in the water-bath at about 45° C., filtered, and is then ready for use. The hot emulsion can be coated once or twice upon the surface of any suitable transparent material of convenient shape, size, and thickness. If the power of such screens has to be increased, solutions of aniline—or methyl—(orange and violet methyl) colouring substances can be added to the solution either before or after solidification.—Eng. Pat., No. 8,368, 1908; “B.J.,” Sep. 25, 1908, p. 740.

The Modern Studio.—A series of articles by Mr. Drinkwater Butt dealing with the building and decoration of photographers' premises is published in consecutive issues of the “B.J.,” March 27, 1908, and concluded May 22, 1908. The working plans are given for shop-fronts, etc., a number of photographs are reproduced illustrating modern studios, and a complete set of drawings for a modern photographic establishment issued as a supplement to the “B.J.” of May 15, 1908.

Lenses and Photographic Optics

Distortion in Symmetrical and Unsymmetrical Lenses.—Dr. E. Wandersleb has published a shorter and more popular version of his exhaustive paper in the “Zeitschrift für Instrumentenkunde.” He combats the notion that a non-symmetrical lens necessarily gives distortion, whilst a symmetrical doublet does not. As his numerous measurements have shown, one cannot speak of “freedom from distortion” at all ranges, since distortion can only be eliminated for a definite scale (N) of reproduction. Once corrected for this scale, other scales will show traces of secondary distortion, the alteration being generally greater with lenses of large aperture, such as $f/4.5$, than with those of aperture of, say, $f/18$. Stopping-down the larger aperture, however, will not remove the distortion.

In the case of a symmetrical lens freedom from distortion is always obtained when copying same size without assistance on the part of the constructor, but large errors of distortion may still exist in the case of reproducing distant objects.—“B.J.,” Jan. 31, 1908, p. 81.

Dr. W. Zschokke, in a reply to Dr. Wandersleb, maintains that the distortion given by symmetrical lenses is negligible, and instances a photograph with straight lines at the edges of the field in proof of his contention.—"B.J.," Feb. 14, 1908, p. 116.

Dr. Wandersleb points out in reply that the lens cited by Dr. Zschokke, the Goerz "Dagor" $f/6.8$, was shown in his earlier article to be one of the best of the symmetrical universal lenses as regards freedom from distortion. He points out that such a lens requires a more delicate test for distortion, such as the following:—A white cord, to the lower end of which a weight is attached, is suspended free in air from the roof of a high building, the wall of which is not too white. This cord represents a straight line. A camera for 10 by 8 or 15 by 12 plates is placed at the window of a middle storey of a house situated opposite. If a "Dagor" $f/6.8$, of focal length 120 mm. (say 5 in.) be fitted to this camera and sharply focussed on the opposite wall (in this investigation at a distance of $a = 10$ yards), then the diameter of the image circle is

$$D = 2f + \frac{2f^3}{a - f} \text{ i.e., in this case a little more than 24 cm.}$$

(9 7-16th in.) for an angle of 90 deg., up to which, the firm's prospectus states, the "Dagor" $f/6.8$ goes when stopped down. The camera is now adjusted so that the image of the white cord

appears at a distance $h = \sqrt{\frac{D^2}{8}}$ in this case, therefore, 8½ cm.

(3 5-16th in.), laterally from the middle of the plate. It then represents the side of a square described in the image circle. Now, if the curve of distortion recently published for the "Dagor" $f/6.8$ be followed to $w = 45$ deg., it will be found that the side of the square, 17 cm. (6 11-16th in.) long—i.e., the image of the white cord—must show a curvature of 0.7 mm., if the lens corresponds exactly with the constructive data on which the curve is based. This result was confirmed up to the available angle of 83 deg. in the case of a "Dagor" of older manufacture. Dr. Wandersleb refers again to his results as emphasising the fact that "there are unsymmetrical objectives in which, for the most important cases, distortion is eliminated to a very much more perfect degree than is possible in symmetrical objectives of a like rapidity."—"B.J.," March 6, 1908, p. 174.

Correction of Distortion.—A reprint of articles which first appeared in "Camera Obscura" by C. Welborne Piper on the rules and formulæ for the correction of distortion produced by tilting the camera, appear in "B.J.," Sept. 11, 1908, p. 694.

Conchoid Lenses.—G. A. Ossart and A. E. Verge have patented a type of lens and the machine for producing it. The lens is characterised by its aplanatism, which is practically perfect, and its large field. A further advantage of the invention consists in the fact that this lens can in practice be employed alone without the employment of a second lens of different material as is usually

done to render a lens achromatic. Finally, the lens is characterised by the fact that it gives a sharp image of objects situated very close to the lens, say 16 inches away and up to infinity.—Eng. Pat. No. 4,527, 1907; "B.J.," Jan. 17, 1908, p. 45.

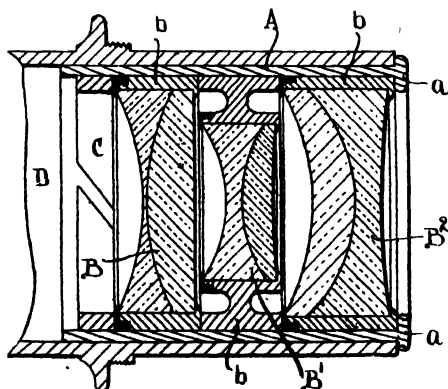
Daniel Wood calls attention to the instruments used by the ancient Greeks for grinding materials for vases, mouldings, etc., of non-spherical shape. Such instruments may serve as models for machinery to be used for grinding non-spherical lenses.—"B.J.," March 20, 1908, p. 226.

R. Steinheil has patented an anastigmat lens in which spherical and chromatic correction is obtained by a construction consisting of four lenses of two kinds of glass, two of which, a double convex and a double concave lens, are cemented together and are arranged before the diaphragm; the two others, a negative and a positive meniscus separated by an air space being arranged behind the diaphragm, the positive lens having each time a higher refraction and less dispersion than the negative.—Eng. Pat. No. 17, 624, 1907. "B.J.," Nov. 8, 1907, p. 846.

TELEPHOTO LENSES.

High-Power Telephoto Lenses.—A. E. Staley and Captain Owen Wheeler have patented the combination of negative lenses whereby various foci of telephoto lenses may be obtained, and the camera extension greatly shortened for a given magnification.

Fig. 1 shows in section the rear portion of a lens mount, provided with a form of the improved negative lens system.



The adapter A, which carries the lens system, is provided with the flanged end a, against which the end lens B² abuts and in front of this lens are placed the remaining negative lenses B¹ and B, three being used in the illustration. The lenses employed are achromatic doublets or triplets, the former being shown in the arrangement illustrated. At the back of the lens system is placed

a split ring C, which holds the lenses in position, the lens cells b, however, themselves fitting closely in the adapter. The set of lenses is introduced from the inner end of the adapter tube, which is removed from the main lens tube D for the purpose of inserting or removing the lenses. At the other end of the lens tube are the ordinary positive photographic lenses. In the illustration the lenses are shown of three different foci, the strongest lens being in the middle, and by properly arranging the order, and inserting the diaphragms if necessary, various corrections can be made, while great variation in size of the image can be obtained by using fewer or more independent lenses.

By this system the same telephoto lens can give a great range of magnifications with a small extension of the camera—Eng. Pat. No. 18,121, 1907. "B.J.," March 6, 1908, p. 183.

Instantaneous Telephotography.—Captain Owen Wheeler, in recommending large aperture lenses for obtaining the greatest rapidity in a telephoto system, finds that amongst commercial lenses available at the time of writing, there is no practical advantage in getting one more rapid than $f/5.6$, those of larger aperture requiring to be stopped down. He finds the best all-round telephoto combination for instantaneous work to be a 7-inch positive combined with a 3-in. negative. This at 3 magnifications has a circle of illumination of about 6½ in. In practice it may be reckoned on to cover pretty sharply a quarter-plate at 3, and a 5 in. by 4 in. at 4 magnifications, the apertures being approximately $f/16$ and $f/22$, and the equivalent focal lengths 22 and 28 inches respectively.—"T. Q.," No. 2, p. 6. "B.J.," July 17, 1908, p. 548.

Reflex Camera for Telephoto Work.—Ernest Marriage describes a camera of the reflex type built specially for telephoto work. It is of solid box form, without bellows or other extension, focussing being done by means of the rack and pinion on the positive lens, which moves forward from the negative attachment, the latter being fixed to the inside of the camera front door. The camera is provided with a projecting box, the full size of the body, which acts as a lens-shade in all directions.—"A.P.," February 25, 1908, p. 184.

A Telephoto Calculator.—A. Thomas has given directions for preparing a chart by the aid of which exposures in telephoto work can be quickly ascertained without calculation.—"B.J.," January 17, 1908, p. 54.

LENS TESTING.

Measuring Working Aperture.—C. Welborne Piper has devised a quick and ready means of finding the working aperture of a lens, which dispenses with the use of a camera as directed by Martin (B.J.A., 1907, p. 712). All that is required is a scale (preferably of millimetres) of about an inch square section, and so ruled that the division lines run nearly across the full width of the scale. The scale is held with its divided edge across the centre of the lens

aperture and pressed against the lens hood. The division lines being at right angles with the edge are also at right angles with the plane of the front of the lens hood, and, therefore, at right angles with the principal planes of the lens. By shifting the scale lengthways and sighting along the zero division we can easily arrange that line in alignment with one edge of the visible aperture. The other opposite edge will then be either exactly or very nearly in alignment with some other division line. If it exactly agrees, we can read the aperture diameter directly from the lines, while if it does not agree we can quite easily sight its position between two lines and estimate the fraction of a millimetre that agrees with it. In making the test it is best to stand so that light falls on the scale and makes the divisions easily visible. The lens need not be directed towards the light, as the edge of the aperture is quite clearly seen if we simply look through the lens at a sheet of white paper.—“B.J.,” April 17, 1908, p. 299.

Measuring Focal Length and Aperture by Inspection.—C. Welborne Piper has worked out a further improvement of the above method, the principles of which are as follows:—

In Fig. 1 *L* is a diagrammatic representation of an objective, and against its hood is placed a broad divided scale *H* of the type described in the above article. The edges of the stop aperture *ss* can be sighted along the lines *a* and *b* in the manner described before, and thus we can determine the effective aperture to be a little over 1.7 inches, say 1.72. The scale can be assumed to show inches and tenths, and it is evident that the aperture extends from the 0.6 division to a little beyond the 2.3 division, say 2.32, so that the total width is $2.32 - 0.6$, or 1.72 in.

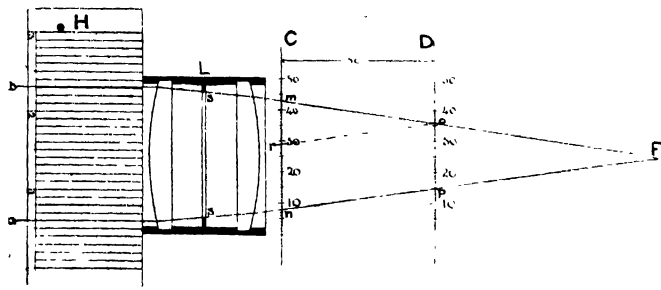


FIG. 1

Now, from the first principles of a lens action, it is clear that when we are looking along the lines *a* and *b* we are directly sighting the principal focus, *F*, of the lens. That is, if we put a point at *F*, it will appear directly in alignment with the edges of the stop aperture when we sight along *a* and *b*. The lines or rays along which we are sighting appear to be continuously parallel, though they are actually refracted by the lens so as to converge on to the point *F*.

Suppose we place at C and D behind the lens two exactly similar equally divided scales C and D. It is evident that the converging lines of sight will intersect C at m and n and D at o and p . We shall therefore see more of the first scale than of the second. When we sight along the line a on scale H, the eighth division on the first scale C and the fifteenth on the second, D, will appear to be in alignment with the right hand edge of the aperture. Similarly, when we sight along b , the 43rd division on C and the 36th on D will appear to be in alignment with the left-hand edge. We can therefore see $43 - 8$, or 35 divisions of the scale C, and $36 - 15$, or 21 divisions of the second scale D. In other words, we see 14 divisions more on the first scale C than on the second D.

If from o on scale D we draw the line or , parallel with np , this will intersect C in r at the 29th division, and the distance rm is then 14 divisions, or equal to the difference between the amounts of each scale that we can see through the lens. It is obvious that the angle mor is then equal to the angle ofp —that is to say, mor is equal to the angular aperture of the lens. If, now we know the distance between the two scales C and D, and into this distance divide the distance mr , we obtain the f number of the angular aperture. In the diagram the separation of the scales is equal to 50 divisions on either of them, therefore

$$\text{the } f \text{ number is } \frac{50}{14}, \text{ or } 3.57.$$

We have already measured the effective aperture on scale H, and found it to be 1.72 inches. If we multiply this by the f number, we obtain the focal length, which works out at 6.14 inches in our example.

It is clear that there is a small error here. We are finding the focal length by multiplying the effective aperture not by the f number of the effective aperture, but by that of the angular aperture. These are not necessarily exactly the same, but in all ordinary cases the difference is so small that it can be neglected quite justifiably. The error, if any, is in focal length only. The f number of the angular aperture is correct, and this is the most important factor that we want to know. In fact, when we apply any one of the various well-known methods of finding the focal length, we only do so with the idea of ultimately finding the f number of the effective aperture, which we only obtain more or less approximately. The angular aperture is of greater real importance, and by the method described in this article we obtain this in the first instance, and with a very close degree of accuracy.

On these principles we can devise a very simple and compact apparatus for measuring lenses, and the two next diagrams suggest a form which could be constructed very easily and at small cost,

In Fig. 2 we have a section of the lens meter. A is the base board carrying the scale D, and scale C is mounted on a table B fixed at a definite known height above A and carried on vertical supports, S S, fixed at the angles. G is a second table, fixed on rods, T T, that telescope into S S. The distance between G and B can thus be regulated to exactly fit the objective, which is placed between them as shown.

Slots are cut in G and B, so that we can sight right through them past the scale C on to the scale D, and the scale H can be fixed vertically above the slot in G.

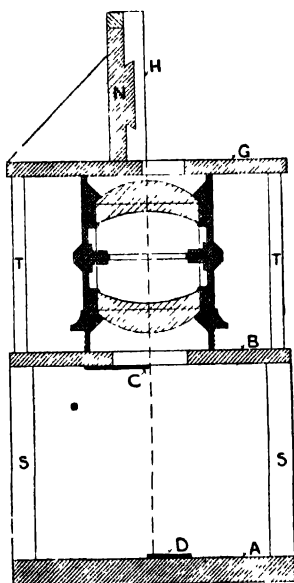


FIG. 2.

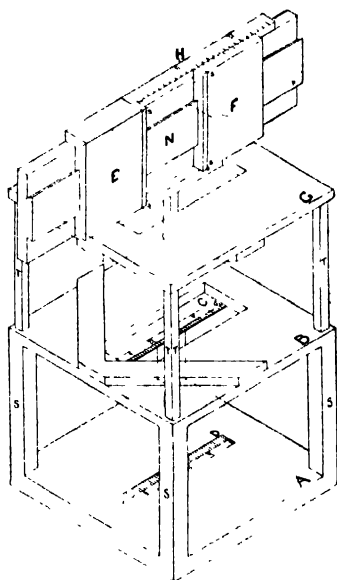


FIG. 3.

In Fig. 3 the apparatus is shown more fully in isometrical projection, and here a V is shown fixed to the upper side of B and the under side of G, so as to enable the objective to be exactly centred over the edge of the scales. The scale H is fitted with a vernier to permit accurate reading of the effective aperture, and the arrangement is rather more complex than the simple scale before described. E and F are two blocks that slide along the board N, which is fixed permanently at right angles to G. The scale H is attached to E, and moves with it, while the vernier is on the edge of F. The edges of the aperture are sighted along the lines s s s s, which can have small point sights at both ends, and if we first adjust E to bring s s in alignment with the edge of the

aperture, and then similarly adjust F, the effective aperture can be read directly off the scale of vernier. The apparatus can be used in an upright position, as shown, and a person with good near sight will find no difficulty in reading the scales beyond the lens. If, however, such a difficulty is felt, it can be got over very easily by using a simple magnifier or reading lens. The scales C and D can be very finely divided, especially if a magnifier be used.—"B.J.," Aug. 21, 1908, p. 638.

Cameras and Accessories.

Reflex Cameras.—A L. Adams has patented a type of reflex camera, in which the mirror, instead of being hinged at the upper hinder portion of the camera, is arranged to move from a point in the lower forward portion of the camera, and, on being released, is guided into a position where it lies flat on the bottom of the camera body, instead of rising into the upper portion. The result of this construction is that lenses of much shorter focus can be used, since the mirror, in its course, has not to pass the projecting lens mount.—Eng. Pat. No. 5,411, 1907. "B.J.," March 27, 1908, p. 244.

Hilton Grundy suggests (and gives the drawings for) an attachment to be fitted to an ordinary camera consisting of a chamber carrying a mirror and a focal-plane shutter, working in conjunction. The accessory replaces the reversing back of the camera, and allows of the latter being used as a reflex instrument.—"B.J.," June 5, 1908, p. 431.

J. E. Thornton has patented a type of reflex camera in which the image is cast upon a white screen in the focal plane, and a mirror used in order to view (through a magnifying lens placed in the top of the camera) the image thus directly formed. Mechanism is provided for shifting the lens forward to an extent sufficient to compensate for the difference between the plane on which the image is formed by the lens (which is the blind of a focal-plane shutter) and the sensitive surface. Eng. Pat. No. 15,199, 1907.—"B.J.," Sept. 4, 1908, p. 683.

Folding Reflex Camera.—C. E. Peczenik and A. J. G. Maskens have patented improvements in the folding reflex camera described in patent No. 21,561, 1903.—Eng. Pat. No. 16,198, 1906; "B.J.," Nov. 15, 1907, p. 868.

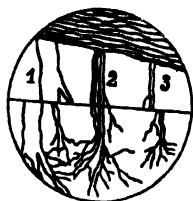
See also the editorial article on "Reflex Cameras," in the early part of this volume.

A New Brilliant Finder.—K. Martin, director of the Emil Busch Optical Works at Rathenow, has devised a new type of brilliant finder, which consists of a concave-surfaced mirror of double curvature, being concave in the line of sight, but convex at right angles thereto. The finder thus does not give a real image, but gives a single bright image, which is partly real and partly virtual, the two

merging into a clearly visible image. The figures show the form of the finder when open for use and when closed.—Eder's Jahrbuch, 1907, p. 62; "B.J.," Dec. 27, 1907, p. 979.



Focussing.—Dr. W. Thorner has patented a method of focussing suitable for both hand and stand camera work, in which the focus is obtained not by observing the sharpness of the image, but by obtaining the coincidence of the images (divided) of objects being



photographed. The figure gives an idea of the observation. The construction of the apparatus is somewhat on the lines of the range-finders used in military and nautical surveying. The basis of the method is explained in Eng. Pat. No. 22,238, 1906, given at length in "B.J.," Nov. 8, 1907, p. 846.

Fine Focussing.—Douglas Carnegie, writing in reference to the fine focussing screens made according to the formulæ given in "B.J.A.," 1907, p. 713, says that though the latter give much more detail than ground-glass screens, yet they labour under the disadvantage that, with the exception of a small portion of the image which happens to lie in the neighbourhood of the line joining the eye with the optical centre of the lens, the image as a whole is much dimmer than in the case of the coarser ground-glass screens, and, therefore, the eyes must be very carefully shielded from extraneous light, in order to permit of the composition and proper centring of the picture on the screen.

A novel screen is made as follows:—A plate which has been exposed in the camera to a uniformly lighted sheet of paper is developed, fixed, and then placed in a bath of hydrogen peroxide acidulated with sulphuric acid. The bath is warmed to a temperature of about 20 deg. C. In a short time the hydrogen peroxide removes the developed silver and concomitantly some of the gelatine in which the silver was embedded, leaving the remaining

gelatine in a very faintly opalescent condition. The plate is now washed, treated with Farmer's reducer if it still looks brown, and dried. A screen so made has just enough optical irregularity to prevent the image being viewed through it, but not enough to militate against the presentation of very fine detail in the focussed image. There is sometimes failure to get a good screen by this process even when observing the same conditions that in previous trials had led to satisfactory results.

TRANSPARENT-PATCH FOCUSING.

A method of focussing, which avoids the trouble of "accommodation," which takes place when a magnifier is used with a focussing screen, containing a transparent patch, is as follows:—

The screen used is a plate of glass fairly heavily ground all over (with a view to a bright general image) with the exception of a small circular central spot, which is left transparent. Such a screen is made in a few minutes by sticking a small washer on the centre of the plate and grinding round this with carborundum powder, using as a muller a small piece of flat glass to which a slab of wood has been stuck to act as a handle. A small strip of tinfoil cut with a razor is stuck across the transparent portion of the screen. On the unground surface of the glass, just over the region of the transparent disc, a small adjustable magnifier of about half-inch focal length is permanently fixed. (The magnifier actually used was constructed from a cheap linen tester.) The magnifier is focussed on the edge of the tinfoil slip and set. It is not necessary to bestow any especial care on this adjustment. The screen is now racked until there is no apparent relative movement (parallax) between the edge of the slip and any selected portion of the image seen through the magnifier when the eye is moved laterally across the field of view of the magnifier. This being the case, the lens image must of necessity lie precisely in the plane of the front surface of the screen. The function of the magnifier here, it will be noticed, is not to aid the attainment of that very uncertain condition, the exact position of clearest visualisation of fine detail in the image, but simply to magnify a displacement. Hence there can be no complications arising from unavoidable accommodative changes in the eye.

The delicacy of this method of focussing—virtually a "null method"—is quite surprising; the most insignificant rotation of the focussing pinion from the position of zero parallax produces an easily perceptible relative displacement of the fiducial mark and any selected image detail.—"B.J.," Oct. 25, 1907, p. 811.

Index Exposure Calculators.—Prof. G. H. Bryan gives examples of the method of drawing up a calculator by which all the factors concerned in the calculation of a photographic exposure are combined by adding up a series of numbers.—"Knowledge," June, 1908, "B.J.," June 19, 1908, p. 476.

INSTANTANEOUS SHUTTERS.

A Test for Jarring Shutters.—A test which can be applied at the

shop counter with a view to judging of the freedom of a shutter from jar is as follows :—

Set the shutter to time, and lay it down on the counter. If this happens to be a glass case so much the better, for the test is then more delicate. Squeeze the bulb and so open the shutter, and note what happens. If the apparatus remains perfectly still it is unusually free from jar. If it moves very slowly and slightly there is not much the matter with it, but if it gives a decided jerk it may be rejected without hesitation.—“B.J.,” Dec. 27, 1907, p. 974.

Artificial Light.

Modern Incandescent and Arc Lamps.—Maurice Solomon has described the recently introduced incandescent electric lamps having metallic filaments and giving greatly improved efficiency. The “Osram” lamp possesses a life of 1,000 to 1,500 hours, during which time it maintains its efficiency of $1\frac{1}{4}$ watts per candle. The Tungsten lamp, which can now be used both vertical and horizontal, is suitable for either direct or alternating current, but has not yet been made for voltages of 100 in such low light units as the tantalum lamps. Two 32-candle-power “Osram” lamps, substituted for one 16-c.p. carbon filament lamp, gave four times the light at less cost. The metal filament lamps have been found suitable for running in series.

Among arc lamps those of M. Blondel (of the flame type) have proved very efficient. The carbons are arranged side by side at an angle of about 15° , the arc spreading into a fan shape, and being kept down at the tips by a magnetic controlling field. An inverted cup above the arc prevents upward air currents, and keeps the arc in an atmosphere of inert gases. The arc gives a light of rich golden yellow colour, although flame arcs of other colours, white and pink, can be produced at an efficiency of 4 to 5 watt per mean spherical candle, or twice to three times as efficient as an ordinary open arc.

The Magnetite arc of Steinmetz and the General Electric Company of America employs electrodes, composed chiefly of magnetic oxide of iron. It has an efficiency of from 8 to 1 watt per candle, and the electrodes (12in. in length) are stated to last 150 hours.—“B. J.” (from “Nature”), July 10, 1908, p. 533.

Magnesium in Oxygen.—F. Stolze points out the convenience of preparing oxygen by pouring water on a finely-powdered mixture of barium peroxide and potass. ferricyanide. These two latter are mixed in molecular proportions, i.e., 170 parts of peroxide to 660 of ferricyanide. 40 gms. of the mixture give a litre of oxygen.—“Phot. Chron.,” June 24, 1908, p. 315.

FLASHLIGHT.

Phosphorus Flash Powders.—Dr. John Bartlett states that in 1887 he used amorphous phosphorus as a constituent of flash-powders, since which time it has come to be used in numerous powders prepared on the lines of “Luxo” or “Blitzpulver.” The composition known up to 1900 as “Blitzpulver” was made as follows :—

Mixed nitrates of barium and strontium 5 ozs.

(Generally 2 strontium and 3 barium.)

Powdered and sifted metallic magnesium 2 ozs.

Amorphous phosphorus (pure and dry) from 120 to 180 grs.

An increase of phosphorus up to a certain extent increased the activity of the powders.

The barium and strontium are first heated in capsule to drive off moisture, finely powdered, and then mixed by sieving in the magnesium; when well incorporated the amorphous phosphorus is carefully added by gently sieving. The substitution of 25 per cent. of metallic aluminium in place of the same amount of magnesium constitutes the present Luxo. This innovation was suggested by the late Mr. Alex. Hemsley, who obtained a patent on all flash powders containing amorphous phosphorus.—"Bull. Phot.," Jan. 1, 1908, p. 1.

Magnesium Time-Light.—Franz Novak, as the result of trial of a number of formulæ for magnesium slow-burning mixture, finds the best to be that composed of magnesium 10 parts, ceric nitrate 7 parts, strontium carbonate 3 parts. 5 gms. of this powder burns in $5\frac{1}{2}$ secs., and gives an efficiency of 160,000 candle-meter seconds per one gramme of magnesium. Mixtures containing calcium carbonate burn very irregularly.—"Phot. Kor.," July, 1908, p. 325; "B.J.," July 17, 1908, p. 545.

A German patent has been taken out by J. Benk for preparations made up in powder or briquette form, and consisting of two constituents of different light-producing powder. A faintly actinic weak red light is first produced, and gradually develops into an intense bright light. The following three mixtures are prepared:—(1) Potass permanganate, 30 per cent.; zinc, 10 per cent.; magnesium, 10 per cent.; iron, 50 per cent. (2) Nitre, 30 per cent.; iron, 30 per cent.; magnesium, 20 per cent.; and aluminium, 20 per cent. (3) Barium peroxide, 33 1-3 per cent.; magnesium, 33 1-3 per cent.; aluminium, 33 1-3 per cent. The mixtures are placed in compact form in the whole composition, and provide the course of combustion above mentioned.—"B.J.," Jan. 10, 1908, p. 27.

A. J. Jarman gives the following two formulæ for slow-burning magnesium powders:—

Powdered shellac 2 ozs.

Nitrate of baryta $\frac{1}{2}$ oz.

Chlorate of potassium 1 oz.

Powdered magnesium 2 ozs.

The shellac causes slow burning. This mixture may be packed in dry cardboard cases 1 to $1\frac{1}{2}$ in. in diameter, and $1\frac{1}{2}$ to 2 in. wide. Zinc or aluminium cases are also well adapted for this mixture, because either of these metals will melt and partly burn, at the same time adding to the brilliancy of the light.

Nitrate of baryta 12 ozs.

Powdered magnesium 10 ozs.

Potassium chlorate 3 ozs.

Flowers of sulphur 2 ozs.

Melted fat from beef suet 6 ozs.

The mixture is made up by adding first the nitrate of baryta, then the magnesium, chlorate of potassium, and lastly the sulphur to the fat in a warm state in an earthen pot, stirred with a glass rod. When the mixture is in the condition of a thick paste, it must be packed in boxes made of zinc or aluminium, not tin-plate. Ignition can be set up by putting into the mixture a piece of cotton-wick or blotting-board that was previously dipped into a strong solution of potassium chlorate and dried. The shellac mixture can be ignited by a lighted match. The only thing to be attended to with this preparation is to keep it thoroughly dry, the chlorate of potassium having a tendency to absorb moisture from the atmosphere.—“Cam,” June, 1908, p. 211.

Materials.

Baryta-Coated Paper.—R. Guillemot, writing of the preparation of baryta paper to be coated with bromide and P.O.P. emulsions, recommends the use of absolutely pure and white gelatine of medium hardness, and of a sulphate of baryta prepared from the carbonate (not the by-product from the manufacture of hydrogen peroxide). He finds that the proportion of gelatine to baryta in the coating should be from 10 to 8 parts of gelatine to 100 of baryta, the former for matt papers and the latter for glossy. He finds that other constituents than these two are of no advantage for the preparation of a paper intended to carry a bromide emulsion.—Bull. Soc. Fr. Phot.; “B.J.,” Nov. 8, 1907, p. 837.

Phosphate Substratum.—York Schwartz has patented a substratum for raw papers to be prepared for photographic printing, consisting of metallic phosphates, particularly neutral calcium phosphate. The phosphate is used with a binding medium or vehicle, and in the proportion of about 40 gms. of “calcium phosphoricum,” as prepared in the British pharmacopœia for each square metre of paper.—Eng. Pat. No. 993, 1907.—“B.J.,” Dec. 20, 1907, p. 964.

Colloid Substances.—Dr. S. E. Sheppard, in a series of lectures at the L.C.C. School of Photo-Engraving, Bolt Court, London, has dealt with the chemical and physical properties of colloid bodies.—“B.J.,” June 12, p. 452; June 19, p. 469; June 26, p. 488; July 10, p. 529; 1908.

Fire-Proof Celluloid Film.—Dr. Eichengrün, in a paper before a society of German chemists, reported that he had made progress in preparing a new acetyl cellulose preparation, to be known as cellit. While transparent, tough, and flexible, it does not easily catch fire, and when lighted is easily extinguished. Moreover, it is strong enough to withstand the wear and tear of the cinematograph taking camera and projector.—“B.J.,” April 17, 1908, p. 298.

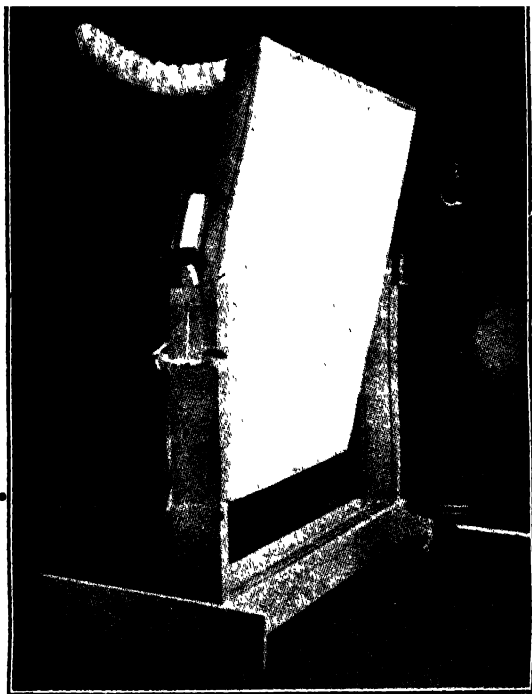
III.—PHOTOGRAPHING VARIOUS SUBJECTS.

PORTRAITURE.

Flashlight Portraiture.—C. R. Ogilvie describes installations for studio flashlight work used by various American photographers. The differences are chiefly concerned with the removal of the smoke from the studio. The figure shows the arrangement used by a photographer in the United States. The swinging frame, six feet square, is backed with asbestos-covered canvas, and the front is covered with semi-transparent cloth. It is open at the bottom, but closed at the top, except for the flexible canvas pipe which connects with a chimney, window, or other opening to the outer air. The smoke is driven out by means of a small electric fan located in the end of the pipe, and operated by a single battery cell. The flash lamp is supported on a frame just inside the small door shown open at the side. Exposure is made by pressing a bulb, which explodes the powder and opens the shutter at the same time. Another American worker has built a partition of tracing cloth extending from floor to ceiling, and about two feet from the front wall of his room. The flash lamp is placed in that narrow enclosure, and the smoke flows out of an ordinary window lowered at the top, the window, of course, being situated in the wall behind the tracing cloth partition. A door at the end makes the placing of a new charge in position but the work of an instant. The light is used exactly the same as a skylight, except that the raising or lowering of the standard supporting the powder pan, together with the moving of the lamp from side to side, does away with the necessity of using curtains or adjusting them for various effects.

A third worker uses a light wooden box about three feet square, lined with asbestos paper, one side, the front, left open except for a covering of thin muslin. This is provided with a smoke outlet in the form of a flexible chimney and with a door for placing the powder on the pan within. This box is swung from the ceiling, and can be moved about and inclined at any angle by means of a

couple of cords. The powder is ignited by means of a push button, which causes a weak current to pass through a short length of very fine wire on which the powder is placed. This short wire becomes red-hot the instant the button is pressed and explodes the powder..



It should be borne in mind that a concussion follows the explosion of all flash compounds, and if one uses a powder that requires more than a few grains to secure the desired amount of actinic light, it will be necessary to have an opening in the box or bag used, to allow of the expulsion of air attending the concussion. This can take the form of a flap that will swing outward and fall back into position before the smoke can escape. Another thing I would like to point out, and that is, the advisability of removing the cloth through which the light passes and washing it out from time to time. Tracing cloth, having a smooth surface, catches little in the way of dust from the repeated flashes, but other cloth is

liable to become clogged up and prevent the light from passing through as it should. If the cloth be soaked for an hour in a gallon of warm water in which has been dissolved seven ounces of ammonium phosphate and two and a-half ounces of common soap, and then hung up to dry, it will be rendered practically fireproof.—“Cam. Craft,” March 1908, p. 95; “B.J.,” May 15, 1908, p. 376.

Portraiture with Mercury Vapour.—G. R. Henderson has found the best arrangement of mercury-vapour lamps to be as shown in Figs. 1 and 2. A wooden bracket is fixed to one of the side walls at a height of 7 ft. The top stands out 18 ins. from the wall, and carries one of the lamps, which is thus 6 ft. 6 ins. from the floor. The second lamp is hung from a batten fixed to the ceiling, and is 18 ins. further from the wall than the lower lamp. This gives an arrangement similar to the ordinary skylight. A wooden frame, as

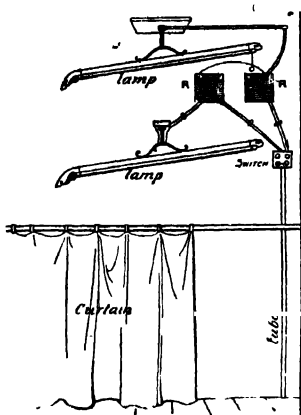


Fig. 1.

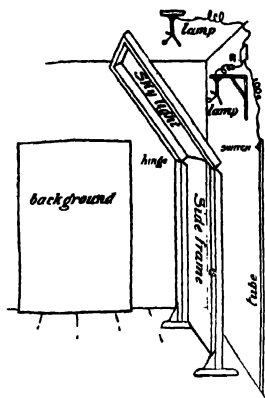


Fig. 2.

used for backgrounds, is fixed to the floor. It measures 5 ft. high by 6 ft. wide. By means of hinges a frame of the same size is fixed to it at an angle (see Fig. 2). The upper frame is covered with muslin, one thickness of “lawn,” is about right for ordinary effects, and is fixed to the upper frame with drawing pins. A curtain is hung over the lower frame in such a way as to be removable when more light is required on the floor.—“B.J.,” Nov. 22, 1907, p. 882.

MISCELLANEOUS SUBJECTS.

Lightning.—J. H. Wilkie finds the use of a slow ortho' plate, such as the Wellington “Ortho Process,” very suitable for the photography of lightning flashes, on account of the freedom from

fog which may easily be produced on a rapid plate by the sheet lightning, which may occur in the intervals between the forked flashes.—“B.J.,” July 17, 1908, p. 554.

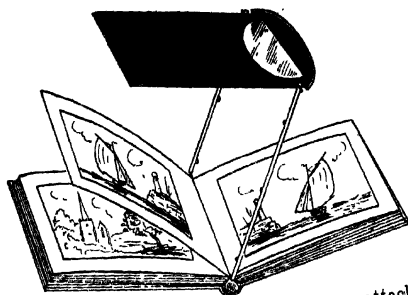
Copying Damaged Prints.—A. Lockett gives the following hints on repairing a print prior to making a copy in the camera:—Water-colours are mixed on a porcelain slab to match exactly the tint of the photograph, but a trifle warmer, since the mixture will dry colder than when wet. Indian ink and crimson lake, with a trace of indigo, will match most tones on albumen or P.O.P. prints; but on a badly faded one some yellow will also be necessary. With glossy prints a slight trace of gum water should be added. Bromides and platinum prints can be matched with Indian ink and a little indigo. The crack is spotted and stippled in gradually with a finely-pointed sable brush, doing the work, if anything, a shade lighter than seems right to the eye, since it tends to photograph darker. When the mount is exposed by the crack and is darker than the print, a little Chinese white must be mixed with the colour. The mixture of colour and Chinese white is also useful for covering stains and dark patches on the print. Fine cracks and scratches may frequently be treated by brushing over with finely-powdered chalk and dusting off the surplus. The cracks will then photograph white, and can be spotted out in the final print. An improvement on this is to mix powdered crayons to match the colour of the print.—“Focus,” Nov. 6, 1907, p. 416.

STEREOSCOPIC PHOTOGRAPHY.

Books of Stereoscapy.—The scattered literature on the stereoscope and stereoscopic vision may be divided into (1) books on the stereoscope and its theory, (2) books on binocular vision written apart from stereoscapy, and (3) books on stereoscopic vision written before the stereoscope was invented. A short description of the chief books and writers of these three classes is given in “B.J.,” Feb. 21, 1908, p. 134.

“*Dixio*” *Stereoscopic System.*—Professor Pigeon suggests (for the making of “Dixio” stereographs as described in “B.J.A.,” 1906, p. 759, and 1908, p. 609) the placing of two large cameras in such a way that the axes of the lenses are at right angles. One of them being fitted with a mirror at an angle of 45° , the pair of pictures can be taken at the proper stereoscopic separation, which could not be done without this device, owing to the size of the camera bodies. Moreover, one of the negatives thus obtained is reversed, as required for the “Dixio” system of stereoscapy.—“B.J.,” April 24, 1908, p. 325.

Stereoscopic Books.—A. Lockett suggests the application of Professor Pigeon’s “Dixio” method of stereoscapy to the production of books of stereoscopic views. A book could be made in the ordinary way with each pair of stereoscopic prints across an

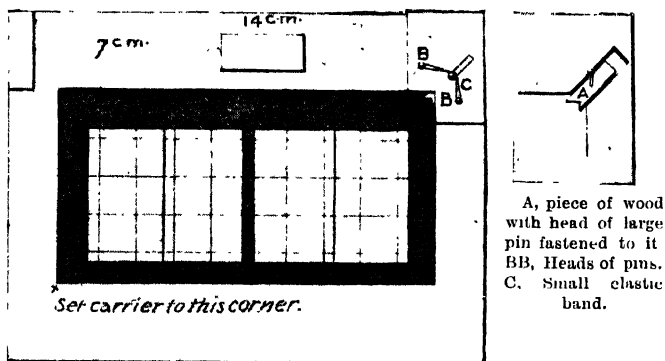


opening, and the separating card with its mirror attached might be fitted so as not to project from the book, and yet to allow of the leaves being turned over.—“B.J.,” Nov. 1, 1907, p. 828.

Printing from Small Stereoscopic Negatives.—David Powell, F.R.M.S., has worked out the following apparatus for the quick and accurate adjustment of the small stereoscopic negatives when printing transparencies therefrom. The dimensions given are for a negative 6×13 cm., and for transparencies of a size for use in the Gaumont “Stereodrome.” A glass 7×14 cm. is cut from the best lantern slide cover glass, and an aperture 73×143 mm. is cut in the centre of a piece of card 13×18 cm. To the back of this card a transparent ruled focussing screen is attached, so that the ruled lines are true to the edges of the aperture (Fig. 1). All parts of the screen (with the exception of the two apertures, which correspond exactly to those parts of the transparency which are seen in the stereoscope) are blocked out. A narrow strip of red paper is attached vertically down each aperture to serve as a guiding line to the required separation between corresponding points in the halves of the negative. A spring clip is fixed at the top right hand corner, and two pieces of cardboard fixed along the top, in order to ensure the 7×14 cm. glass carriers fitting correctly into the printing frame.

To mount the negative a glass carrier is placed in the recess of the template, thus constructed, against the screen, so that the spring clip at the top right-hand corner sets it firmly into the bottom left-hand corner. A small spot of Seccotine is put on each corner of the glass side of each half of the negative, and, laying the halves, transposed, on the carrier, bring them into the most accurate adjustment by means of the lines on the screen viewed through them. As the thickness of the glass of negatives frequently varies at their original extremities, which are now brought together, it is necessary to see that the halves lie flush; if they do not, they should be made level by inserting a small piece of black binding paper between the lower negative and the glass carrier. Great care must be taken to prevent fine threads

of Seccotine falling on the negative. Should, for any reason, the mounting be unsatisfactory, the negative can be detached from the carrier by carefully applying a little water with a paint brush to



The fine ruling on the screen is omitted.

Fig. 1.

the carrier at the edges of the negative, when the water will be drawn between the glass surfaces by capillary attraction, and the Seccotine presently dissolved without any injury to the film.

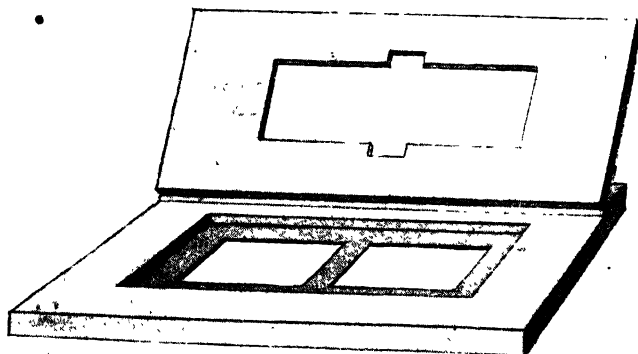


Fig. 2.

The printing frame is the next object of attention. The box form with hinged bars is necessary, and a wooden carrier, of sufficient depth to allow a thin blackened cardboard mask as well as the glass carrier with the superimposed negative to lie flush

with its surface, is required. The mask has two apertures corresponding with those in the template, but a shade larger, and is so adjusted in the wooden carrier that when the glass carrier is set well into the bottom left-hand corner of the wooden carrier the same pictures are seen as were visible when it was in the template.

To the top side of the wooden carrier a sheet of blackened cardboard, with an aperture very slightly larger than the size of the transparency plate, namely 6×13 cm., is attached by a linen or tape hinge, and so arranged that, when lying down over the negative, the transparency plate, dropped into its aperture, is truly placed to receive the image from the negative. This hinged carrier must, of course, be of less thickness than the transparency plate, otherwise the latter will not receive the pressure from the back of the printing frame.

The resultant transparency will have two pictures neatly surrounded by clear margins, one of which may be utilised for the inscription of the title of the photograph.

If printing is effected by artificial light, it is necessary to employ a ground glass screen of, say, 12×15 ins. in size at a distance of 6 or 8 ins. from the printing frame, in order to diffuse the light: otherwise rust or minute imperfections in the glass of carrier or negative will appear as clear marks in the transparency and entirely spoil its perfection.—“B.J.” Jan. 10, 1908, p. 24.

Lappmann Stereo Lens Plate—An account of this invention appears in “B.J.” March 13, 1908 p. 192

IV.—NEGATIVE PROCESSES.

Cellulose Emulsions.—Dr. L. Lederer has patented the use of pure acetic acid in forming an emulsion of acetyl cellulose. To 1,000 c.c.s. of 2½ per cent. solution of cellulose acetate in acetic acid 35 gms. are added of a mixture of crystallised strontium chloride (45 parts), anhydrous lithium chloride (15 parts), water (9 parts), and absolute alcohol (20 parts). To the mixture thus produced are then added glycerine 25 gms. mixed with absolute alcohol 25 gms., after which a solution of silver nitrate 30 gms. (in water 40 gms. and absolute alcohol 75 gms.) is added in a thin stream with continuous shaking. Lastly, after thorough mixture, 10 gms. of citric acid dissolved in 40 gms. of absolute alcohol are added.—Eng. Pat. No. 26,503, 1906; "B.J.," Dec. 20, 1907, p. 965.

Sensitiveness of Plates at Different Temperatures.—R. J. Wallace, as the result of examining plates at temperatures varying from 100° C. to -14° C., has found that the apparent discordance of the result obtained by Abney and King is to be explained by the fact that whilst, according to Abney,¹ increase in temperature results in added speed, according to King,² greater speed, even to 50 per cent., is obtained by a decrease in temperature. In reality it simply depends upon which portion of the curve is taken as to whether the speed is increased or reduced—i.e., whether one considers faint objects with consequent low photographic densities, or bright objects with full exposure and consequent high densities.—"B.J." (from "Astro-Physical Journal"), Aug. 28, 1908, p. 661

Orthochromatic Processes.

Principles of Orthochromatic Photography.—A paper by Mr. R. J. Wallace contains a useful scientific statement of the principles of orthochromatic photography.—Reprinted in "B.J.," May 22, 29, and June 5, 1908, pp. 398, 414, and 432.

Colour Sensitisers.—R. J. Wallace has carried out sensitometric tests of all the chief dyes, in particular, pinacyanol, pinaverdol, pinachrome, homocol, and dicyanin. Also orthochrome T, cyanin, ethyl violet, tetra-iodo-fluorescein, and ethyl cyanin T. These were used singly and together in sets of two or more, in water or alcohol solution, and with water or alcohol washing. The effect of varying the temperature of the sensitiser was also tried over a range of from 12° to 30° C. The plates were dried in a cupboard through

¹ "Action of Light in Photography," London, 1897.

² "Photographic Photometry," "Photo Beacon," 1905 p. 267

which a filtered air supply, heated by electricity, was passed at a temperature of about 32° C. Three acetylene and two daylight spectra were impressed on the one plate, the latter to give the Fraunhofer lines and to serve as a check upon tests made as a preliminary to this full examination. The rest of the plate was exposed to daylight in a rotating sector machine ("B.J.," May 17, 24, and 31, 1907), together with an unbathed plate of the same batch. On development together the relative speed was obtained. After checking the daylight plates against the corresponding acetylene plates, the former were measured in the spectro-photometer and their densities plotted, selecting that spectrum exposure on each plate, which gave an approximate density of 2.5 in the blue violet. The results aimed at (and recorded) are those giving sensitiveness throughout the entire spectrum, or special important sensitiveness for a limited region.

X colour sensitiveness is not recorded as by Sheppard and Mees, e.g., $\frac{\text{yellow inertia}}{\text{blue inertia}}$ but is obtained from the ratio of the density measured directly from the spectrum plate. Thus,

$$X = \frac{\text{density of blue at } \lambda 4100 (= \beta)}{\text{density at } \gamma n}$$

As with Sheppard and Mees, the lower the value of X the higher the chromatic sensitiveness.

It was found that slow plates were unsuitable for bathing. A plate must be free from fog and have a development factor (for blue-violet light γ & β) as low as possible, so as to give maximum development action without excessive density in the blue violet.

Development of the Test Exposures was done in 70 litres of bath kept at constant temperature and in total darkness. As regards duration of exposure, it is sufficient that the spectrum plate be developed with the same developer (for the same length of time and at the same temperature) as the sector disc plate of the same construction, which, when measured, records a value of γ 1.3. For this a Seed "27" requires three minutes' development in 1:24 rodinal at 20° C.

Increase of Temperature of Dye Bath benefits colour-sensitiveness of plate. The bath is best kept at 23° C

Pinacyanol was found to give increased red-sensitiveness with increase of ammonia in the dye bath. Alcohol in the dye bath and omission of washing gave greater action between 5,270 and 5,890, while after-rinsing with alcohol gives further increase. A dye solution of 1 in 68,000 to 1 in 70,000 was found to give the greatest sensitising action. (Agreement with Mees and Sheppard.)

The reduction in speed is .19.

Pinaverdol sensitises best for green and orange-red in a bath of—

Pinaverdol, 1:1,000	60 minims
Methyl alcohol	3 ozs.
Water	4 ozs.
Ammonia	60 minims

used for three minutes and plates not washed. Speed reduction, .60.

Homocol sensitises from 4,860 to 5,460, and when made up with alcohol, and plates alcohol-washed, gives great clearness. It does not sensitise so far into the red as pinaverdol, but is unequalled as a sensitiser for blue-green. Speed reduction, '61.

Pinachrome in dilute alcohol-ammonia bath sensitises for the yellow-green and orange, showing the α and $\frac{\beta}{\omega}$ bands of cyanin. Sensitiveness extends to 6,300, or can be forced 6,500. Speed reduction, '36.

Pinacyanol-Homocol was made as follows:—

Pinacyanol, 1 : 1,000	60 minims
Homocol	60 minims
Alcohol, ethyl	3 ozs.
Ammonia	90 minims
Water, distilled	4 ozs.

Though action is fairly even in red and green, yet it is weak compared with that in red, particularly if ammonia is omitted. Speed difference, '74.

Pinacyanol-Pinaverdol-Homocol gave the best of all results, being very clean and free from fog:—

Pinacyanol, 1 : 1,000	50 minims
Pinaverdol, 1 : 1,000	40 minims
Homocol, 1 : 1,000	40 minims
Ammonia	120 minims
Alcohol	3 ozs.
Water	4 ozs.

which is used for four minutes, and plates alcohol-washed for thirty seconds. Sensitises through entire visible spectrum, extending to 7,200, closing the usual gap in the blue-green, and giving a smooth even curve throughout. Speed difference, 13 p.c.

Pinacyanol-Pinaverdol-Dicyanin is made up—

Pinacyanol, 1 : 1,000	30 minims
Pinaverdol, 1 : 1,000	60 minims
Dicyanin, 1 : 1,000	40 minims
Ammonia	120 minims
Alcohol	3 ozs.
Water	4 ozs.

in which plates are bathed three minutes and water-washed thirty seconds. Good sensitiveness from blue-green to red. (7,200 or Fraunhofer A.) Speed difference, 1'64

Addition of homocol to the above bath increases and evens the panchromatism, but reduces speed. Difference, '91.

The bathed plates issued by Wratten gives a smooth curve of sensitiveness extending beyond 6,870. The slow panchromatic has a remarkably low gamma infinity β .

Compensation Filter.—To make the curve given by the above-mentioned formula of pinacyanol, pinaverdol, and homocol a straight line, the use of a compensating filter is better than staining of the film of the plate. The best formula yet found is prepared with the two following stock solutions:—

A. Tartrazine	0.1 gm.
Water	100.0 c.c.s.
B. Naphthylamine Brown	0.01 gm.
Water	100.0 c.c.s.
Compensation filter=A.	10 c.c.s.
Water, 120 c.c.s.	
B.	40.0 c.c.s. in a thickness of 5 mm.

This filter increases exposure 22 times.—“B.J.” (from “Astro-Physical Journal”), Jan. 31, p. 83; Feb. 7, p. 101; and Feb. 14, p. 119, 1908.

Non-Screen Colour-Sensitive Plates by Bathing.—Dr. E. König gives the following formula for a bathing solution containing a dye which shall provide the plate itself with the screen necessary for pronounced orthochromatic effect. He points out that this dye must be easily soluble in water, it must stain the gelatine, but must be easily washed out; it must not react with the sensitiser, or be prejudicial to the keeping powers of the film. All these conditions are perfectly fulfilled by “filter yellow K,” which is already well known in England.

To make the sensitiser, 5 gms. of filter yellow K and 0.1 gms. of erythrosine should be dissolved in 600 c.c.s. of distilled water, and 300 c.c.s. of alcohol added. Methylated spirit may be used. In this solution, which will keep indefinitely, the plates should be bathed for two or three minutes and dried without washing. The bath may be used over and over again, and only needs filtering from time to time. The plates are always clean, free from streaks or spots, and will keep for three months unchanged.

In developing some of the yellow dye remains in the developer, and some in the fixing bath. After a short washing the plate is quite free from stain. Neither the developer nor fixing-bath is spoilt by the yellow dye.

Attempts to make a panchromatic plate with pinachrome and “filter yellow K” were not satisfactory. The sensitising with pinachrome is strongly reduced by the yellow. On the other hand, success was met with in making a bath with pinacyanol for panchromatising by adding to 300 c.c.s. of the above-named bath 2 c.c.s. of a 1:1,000 pinacyanol solution. Plates thus prepared show an extraordinary action in the yellow, orange, and red: only the green sensitiveness left something to be desired.

The sensitiveness of the plates, sensitised with erythrosine, to daylight is about 0.4 times less than the sensitiveness of the un-bathed plates.—“B.J.,” Oct. 18, 1907, p. 786.

Achille Carrara recommends the following modification of Dr. König's formula for panchromatic non-screen plates on account of the greater sensitiveness to green. The dye bath is as follows:—

Filter yellow K, 10 per cent. sol.	25 c.c.s.
Erythrosine, 1 per cent. sol.	5 c.c.s.
Pinacyanol, 1 in 1,000 sol.	1½ c.c.s.
Pinaverdol, 1 in 1,000 sol.	1½ c.c.s.
Distilled water	420 c.c.s.

The plates were bathed for 3-4 minutes, rapidly rinsed under the tap for the time necessary to bathe a second plate, and were left to dry spontaneously overnight.—“B.J.” (Colour Supplement), Dec. 6, 1907, p. 89.

R. Namias has modified the recent formula of Dr. E. König. The two following baths were tried:—

I. Water	1,000 c.c.s.
Naphthol yellow	5 gms.
Erythrosine	1 gm.
II. Water	1,000 c.c.s.
Tartrazine	5 gms.
Erythrosine	1 gm.

the plates being bathed in one or other for five minutes and dried in the dark without washing. It was found that a clear, almost uniform, spectrum was obtained with only a small minimum of sensitiveness in the green. Blue and violet act less energetically, since in these parts of the spectrum there is not the absolute white band which is obtained on ordinary (non orthochromatic) plates, or those sensitised with erythrosine only.

Camera exposures made with the plates have also shown the excellent results obtainable, the rendering of the greens being very much better.—“Phot. Couleurs,” May 1908, p. 135; “B.J.” (Colour Supplement), July 3, 1908, p. 52.

Non-Screen Ortho' Plates.—T. MacWalter has patented the addition to the emulsion of filter yellow K in the proportion of about 5 c.c.s. of dye solution (1 part of dye to 40 c.c.s. of water), to 200 c.c.s. of emulsion. This mixture is coated on the glass plates or film in the usual way. Eng. Pat. No. 17,452, 1907.—“B.J.,” March 20, 1908, p. 220.

T. MacWalter has patented the addition to a dry-plate emulsion of tartrazine with the object of forming in the film the screen necessary in ortho work. By adding 5 c.c.s. of a solution of tartrazine (containing about 1 gm. of the dye in 40 c.c.s. of water), to 200 c.c.s. of emulsion, a suitable mixture is obtained.—Eng. Pat., No. 17,453, 1907; “B.J.,” Aug. 28, 1908, p. 666.

L. Husson and A. F. Boino have patented the application of a thin coating of wax to the gelatine surface of an ortho' plate, and the subsequent application of a colour solution composed of

Alcohol 95 per cent.	1 dram.
Liquid glucose or glycerine	2 oz.
Aniline colours	(about) 6 gr.

It is not stated how the wax coating is to be removed before development, or whether such operation is necessary. Eng. Pat. No. 25,728, 1906.—“B.J.,” Dec. 5, 1907, p. 925.

Dicyanine Plates.—C. E. K. Mees and S. H. Wratten, after succeeding in preparing dicyanine-bathed plates, have been able to confirm Monpillard's statement that dicyanine greatly reduces general sensitiveness. But much less dye than can be used in the

case of other cyanins must be employed, rather less than 1:100,000. Plates should be dried rapidly, otherwise the dye fades out during drying. Plates retain their colour-sensitiveness for months without drop. The authors find dicyanine to give complete absence of sensitiveness from 5,200 to 6,000. The maximum is at 6,950; there is a second with about one-quarter the sensitiveness at 6,450.

Owing to the peculiar sensitiveness, dicyanine plates exposed through a yellow screen will greatly exaggerate the intensity of white clouds against a blue sky, rendering quite clearly bands of vapour which are almost invisible to the eye. This is due to the small amount of extreme red light in blue skylight.—“Phot. Journ.,” Jan. 1908, p. 25.

Acid Diamidophenol Developer for Orthochromatic and Panchromatic Plates.—Dr. E. Stenger has tested the claims made for the acid amidol developer as a means of so reducing the colour sensitiveness of ortho’ and panchromatic plates as to admit of their being developed with safety in the ordinary dark-room illumination. He used a dark-room light, which passed rays from 640 to 720 μ μ , together with some green rays, but he found no advantage, but the reverse, in using the acid amidol developer of Balagny. (See under “Negative Processes—Developers.”) The tests were made in comparison with rodinal, companion plates being allowed to develop within 20 ins. of the dark-room light. In every case the fog was as much, or more, with acid amidol as with rodinal.—“Phot. Chron.,” Aug. 2, 1908, p. 383. “B.J.,” Aug. 14, 1908, p. 617.

Monochromatic Prints from Autochrome Plates.—Dr. H. D’Arcy Power records the satisfactory orthochromatic effect obtained by printing from an Autochrome positive on carbon tissue. The colour sensitiveness of the bichromated tissue is sufficient to reproduce the tone values of the colours occurring in minute subdivision over the Autochrome plate.—“Phot.,” March 17, 1908, p. 223.

DEVELOPERS AND DEVELOPMENT.

DEVELOPERS.

Making-up Amidol.—Failure to secure proper developing action may be caused by adding the amidol to a strong solution of sulphite and metabisulphite (see formula under “Developers and Development”) in too heavy doses. The developer thus made up may be found to be strongly acid and without developing action. Addition of further sulphite will put matters right. Apparently the effect does not take place when the sulphite is diluted before adding the amidol.—“B.J.,” Aug. 14, 1908, p. 614.

Ferrocyanide in the Hydroquinone Developer.—John Beeby, in “Down Town Topics,” revives and recommends as a soft working hydroquinone developer the following:—

A. Hydroquinone	...	...	150 grs.	9.7 grms.
Ferrocyanide of potassium	..	..	390 grs.	25.2 grms.
Sulphite of soda	...	...	540 grs.	35.0 grms.
Water	...	..	35 ozs.	1000 c.c.s.
B. Caustic soda	...	..	2 ozs.	100 grms.
Water	...	..	12 ozs.	600 c.c.s.

These solutions are mixed in the proportion of about two ounces of A to five to eight drachms of B. The developer is recommended as equally suitable for bromide papers, particularly when printing from harsh negatives.—“B.J.,” Aug. 28, 1908, p. 654. [It might be interesting to try whether the ferrocyanide in the developer in any way affected the subsequent sulphide toning of the prints as regards colour.—Ed. B.J.A.]

Diamidophenol in Acid Solution.—G. Balagny, in recommending this developer as of universal application, states that it should be silver grey in appearance, and will keep in the dry state for six to eight months. It is made up with sodium sulphite and sodium bisulphite solution, the latter rendering the solution acid without decomposing it. Bromide has little action when much sulphite is present, but its action is powerful in developers containing little sulphite.

FORMULA IA.

Diamidophenol	1 gm.	15 grs.
Sulphite of soda, anhydrous powder	2 grms.	30 grs.
10 per cent. ammonium bromide solution	5 c.c.s.	85 minims.
Sodium bisulphite solution, 35 deg.		
Baumé.....	5 c.c.s.	85 minims.
• Water.....	150-175 c.c.s.	5 to 6 oz.

This bath is made up as follows:—Into a glass flask, holding 250 c.c.s. (8½ ozs.), are put 10 c.c.s. (1¼ ozs.) of water, the gramme of diamidophenol is dissolved in it, and then the sulphite, or the two together. The water is then added. This is better than taking the full quantity of water in which to dissolve the diamidophenol and sulphite; a little water shaken round with the two substances dissolves them better than the full quantity. Five c.c.s. of the bromide solution are then added from the graduated measure. The quantity given is the maximum; it can be reduced down to 1 c.c. or left out altogether, according to the character of the work which is being done. In summer, in the case of exposures on the sea, the full 5 c.c.s. are often necessary; in winter the bromide may be dispensed with, or a drop or two used. It is well to remember that the figure of 5 c.c.s. may be generally adopted, but it is not necessarily invariable. Finally, the 5 c.c.s. of bisulphite are added; this quantity is invariable.

The formula is used exactly as above once the plates are ready for development; that is to say, it is not necessary to modify it during use.

An alternative formula is the following, in which the sulphite and bisulphite are mixed together in a separate solution:—

SOLUTION S.

125 c.c.s. ($4\frac{1}{4}$ ozs.) of water are placed in a graduated flask, and 20 gms. (310 grs.) sulphite of soda added and shaken until dissolved.

75 c.c.s. ($2\frac{1}{2}$ ozs.) of bisulphite of soda solution are then added, and the whole, after shaking, transferred to a 250 c.c.s. bottle ($8\frac{3}{4}$ ozs.), pouring in any sulphite which is not completely dissolved. The solution will be clear on the following day. This formula, it will be seen, gives one gramme of sulphite and 3 to 3.75 c.c.s. of bisulphite per 10 c.c.s. of liquid. It is also found that as soon as the mixture of sulphite and bisulphite has been made, all odour of sulphurous acid disappears. A liquid prepared in this way will keep for more than a year, the only change that can occur being a deposition of a little sulphite crystal, although this is of rare occurrence, the solution being only of 10 per cent. strength. As regards the cause of the disappearance of the sulphurous odour, it may be that a new compound is formed on mixing the two substances. A saturated solution of sodium sulphite contains, at 15°C , 25 parts in 100 parts of water, and its reaction is sharply alkaline. It is found that 1 c.c. of commercial sodium bisulphite solution (Poulenc) is sufficient for neutralising 15 c.c.s. of the saturated solution of sodium sulphite. On adding 1 to 5 c.c.s. the mixture becomes sharply acid. In preparing the above S solution, a saturated solution of sulphite has its alkalinity destroyed by 6 c.c.s. of bisulphite solution. The other 69 c.c.s. are, however, free to act as an acid salt. It may be assumed that the sodium sulphite is not decomposed, since there is no evolution of sulphur dioxide; in this case its action would be simply veiled by a small quantity of acid bisulphite (NaHSO_3). These two salts would exert on the salts of silver each its separate action, the acid salt preventing the injurious effects which are met with in alkaline development.

FORMULA IIA.

Diamidophenol	1 gm.	15 grs.
10 per cent. ammonium bromide solution	5-10 c.c.s.	85-170 mms.
Solution S.....	7 c.c.s.	120 minims,
		to begin with.
Bisulphite of soda solution	3 c.c.s.	50 minims.
Water	150-175 c.c.s.	5 to 6 ozs.

It will be seen that this formula is on all fours with IA, the proportion of water, diamidophenol, and ammonium bromide being the same. The only difference is in the sulphite of soda, the 7 c.c.s. of solution S. representing a little less than 1 gm. sodium sulphite. As for the bisulphite, although these 7 c.c.s. contain about 3 c.c.s. of bisulphite, this latter is insufficient, and a further 3 c.c.s. is therefore added, which makes the total of bisulphite about 2 c.c.s. more than in the formula IA. This latter formula (IIA) is designed for the development of well-exposed subjects, and the bath is therefore rendered rather more acid, and therefore less rapid in action. Yet the bisulphite should not be further increased; there is no need to fear markings, even if the plates have to be left in the developer a long time in the ordinary dish. In using the formula a plate in a perfectly clean dish is treated with the solution IIA as above, and

a graduate placed at hand containing 10 to 20 c.c.s. ($\frac{1}{4}$ to $\frac{1}{2}$ oz.) of the S. solution. The negative, having been treated with the developer for about half a minute, is covered with a card and allowed to proceed without being again examined for three or four minutes. Usually the image will be visible at the end of this time. It should show in a case of great over-exposure, and we are here prescribing for exposures which, perhaps, have been too great. If at the end of two to five minutes there is no appearance of the image, 2 c.c.s. ($\frac{1}{2}$ dram) of S. solution may be added, and a further three to five minutes given before adding a further 2 c.c.s., these successive additions being made with the object of finding the point at which development commences. This having been found the subsequent development will be as in ordinary work, the image will gradually appear, and the final result is an excellent negative with full detail.

For bromide papers the following formula is used:—

Diamidophenol	1 gm.	15 grs.
Sodium sulphite, anhydrous powder ...	2 grms.	30 grs.
10 per cent. solution ammonium bromide	5 c.c.s.	85 minims.
Sodium bisulphite solution:	10 c.c.s.	170 minims.
Water	150 c.c.s.	5 oz.

In bromide work the same precautions as to the avoidance of dishes which have previously been used for alkaline developers are particularly essential. Development takes place slowly, the high-lights appearing first, then the half-tones, but there is not the slightest fog unless excessive exposure has been given. This is the only cause of failure. Moreover, the developer gives no stains, and the colour of the prints is an excellent black. The only way in which the worker can go wrong is in obtaining a greenish colour on the prints, due to too much exposure. On the other hand, insufficient exposure may give rise to a yellowish colour. One hint which may be given in regard to prints which are slow in reaching the desired vigour is to lay them in the developing bath face down; they are turned over to judge of the progress being made.—“B.J.” (from “*Monographie du Diamidophenol en Liqueur Acide*,” published by MM. Gautier-Villars, Paris), July 17, p. 546; July 24, p. 560, 1908.

Pyramidol Developer.—Dr. Georg Hauberrisser describes a new substance named Pyramidol, said by the makers, the Brugg A. G., to be a chemical compound of hydroquinone and paramidophenol. As regards speed of development, there is not much to choose between pyramidol and the mixture of its constituent bodies, but Dr. Hauberrisser states that in suitability for dealing with over-exposures by the addition of potassium bromide, the new developer is of quite exceptional character. A suitable formula is:—Pyramidol, 15 grains; soda sulphite, 160 grains; potass. carbonate, 160 grains; water 7 ounces. This, with a normal dose of bromide, developed a correct exposure in four minutes, whilst another plate which had received sixteen times the correct exposure was treated with the same solution dosed with four times the bromide. Development took nine minutes, and gave a negative in every way as good as that correctly timed.—“*Phot. Korr.*,” June, 1908, p. 273; “B.J.,” June 12, 1908, p. 447.

Pyro Solutions.—A. and L. Lumière and A. Séyewetz in devising a stock solution for the development of Autochrome plates used at first alcohol as a preservative, sulphite of soda not being admissible owing to its solvent action on the silver bromide of the film. They have found that commercial sodium bisulphite solution in small quantity forms an efficient preservative of pyro not only in alcoholic but in water solution. Their results are:—Solutions of pyrogallic acid in water discolour both in and out of contact with the air, but the discoloration is considerably more rapid in the former case. Light appears to have no appreciable action on the change. Solutions prepared with ordinary water discolour more rapidly than those in distilled water. In both cases the rapidity of discoloration increases with the strength of the solution. The addition of commercial sodium bisulphite in very small quantity prevents the discoloration of these solutions. The proportion of bisulphite necessary decreases with the strength of the pyro solution. For one litre of 3 per cent. pyro solution 1 c.c. of bisulphite solution is needed; for the same volume of 50 per cent. pyro solution 2 c.c.s. of bisulphite are required. The solutions of pyro and bisulphite in water can be conveniently employed in place of the solutions in alcohol for the development of Autochrome plates, as also for almost all other photographic processes.—“B.J.,” Dec. 6, 1907, p. 920.

Pyrocatechin Developer.—Dr. E. König calls attention again to the excellent properties of the pyrocatechin developer—namely, its first-rate keeping qualities, great freedom from fog, and ready adaptability to restraint with potassium bromide.

An important point in compounding it is to use the caustic alkali in *exactly* the proportion given. It is better to add the caustic soda from a solution of known strength, such as is commercially obtainable. Thus, for the caustic potash solution of 32 per cent., 87.5 gms. solution is taken in place of 28 gms. of the pure (100 per cent.) solid alkali. Commercial solid caustic potash is never 100 per cent.

A. Pyrocatechin	...	...	55 gms.	480 grs.
Sodium sulphite cryst.	...	...	35 gms.	300 grs.
Water to make	...	...	500 c.c.s.	10 ozs.
B. Caustic soda, 100 per cent	...	...	28 gms.	245 grs.
Sodium sulphite cryst.	...	...	150 gms.	3 ozs.
Water to make	...	...	500 c.c.s.	10 ozs.

The volume of each separate solution should thus be 500 c.c.s. To make up the developer the following proportions are taken:—

A. 10 c.c.s.	B. 10 c.c.s.	water 150-250 c.c.s.
or, A. $\frac{1}{4}$ oz. (fl)	B. $\frac{1}{4}$ oz. (fl)	water 4 to 6 ozs.

Using the smallest proportion water given above (150 c.c.s. or 4 ozs.) greater density is very easily obtained.

In this developer one hydroxyl group of the pyrocatechin is entirely, and the other, half saturated. If a weaker acting developer is required, the following may be made up:—

A. 15 c.c.s. B. 10 c.c.s. water 200 c.c.s.
or, A. $\frac{3}{4}$ ozs. (fl) B. $\frac{1}{2}$ oz. (fl) water 10 ozs.

the composition of which, when applied to the plate, corresponds with the formula $C_6H_5(OH)(ONa)$. On the other hand, a most energetic developer is produced by taking solutions as follows:—

A. 10 c.c.s. B. 15 c.c.s. water 200 c.c.s.
or, A. $\frac{1}{2}$ oz. (fl) B. $\frac{3}{4}$ oz. (fl) water 10 ozs.

This developer approximately corresponds with the formula $C_6H_5(ONa)_2$. "B.J.," Aug. 21, 1908, p. 636.

TIME DEVELOPMENT.

Development Speeds of Plates.—Mr. Alfred Watkins announces that the development speed of commercial plates will in future be given on the Watkins' speed card. Plates will be designated by letters from V.Q. (very quick), representing a time of about $2\frac{1}{2}$ minutes at 60° F., with the Watkins' developer to V.S. (very slow), representing about $11\frac{1}{2}$ minutes under the same conditions.—"Phot.," May 12, 1908, p. 4.

Time Development.—Mr. Alfred Watkins has worked out a concentrated developer which is diluted for use, and is supplied with a scale affixed to the bottle, by which the time of development can be adjusted for variations in temperature. Particulars of the time required by commercial dry plates to develop are given, and the use of the ready-made developer and the firm's classification of dry plates with regard to time development thus permits of photographers making more extended use of this system.—"B.J.," May 29, 1908, p. 413.

Mr. Watkins has patented the means for calculating the variations in time required by various temperatures of the developer, basing his system upon variation in speed of development of plates or films according to the temperature, as represented, for ordinary limits of temperature, by the equation.

$$V(t + t) = V_T \times k^t$$

where V_T denotes the speed of development at T° C.

$V(t + t)$ denotes the speed of development at $(t + t)^\circ$ C.

and k denotes the temperature coefficient for 1° C.

If, therefore, the speed of development of a given plate is determined experimentally for a given developer at two different temperatures, the temperature coefficient for that developer and plate can be calculated, and the value obtained used to determine the speed of development or relative time of development for other temperatures.

His apparatus comprises relatively movable scales, one of which is a logarithmic scale representing times of development, and the other an equal-division scale the length of the divisions of which is determined by the value of the temperature coefficient proper to the plate and developer used. By setting the scales with the division corresponding to the known time of development at a given

temperature in register with the division representing that temperature, the relative time of development for any other temperature can be immediately read off.

For developers which are sent out in liquid form one scale may conveniently be pasted around the bottle and the other displayed on a band which moves round the bottle. For developers which are sent out in other kinds of packages the movable scale might be displayed around the edge of a circular disc rotatable concentrically with the fixed scale. Eng. Pat., No. 22,456, 1907.—“B.J.,” Aug. 21, 1908, p. 646.

Factorial development in tanks and machines.—Professor G. H. Bryan recommends the following method of testing the activity of a developer when using the time method in tanks and film developing machines :—All that is necessary is to test the developer by inserting a very small strip of exposed bromide or gaslight paper and watching it blacken up in ordinary daylight, like the paper does in an actinometer. We first insert the end of the slip and let it blacken. We then immerse a further length and count, with a watch, the number of seconds, or minutes, that elapse till this portion is indistinguishable in colour from the part first inserted. This time determines the speed of the developer, and it is only necessary to multiply this time by a suitable numerical factor, previously determined, in order to find the correct time of development of a properly exposed negative in the developer in question.

With metol-hydroquinone satisfactory results are obtained by using the factor 20. At the same time the choice of a factor must necessarily depend much on individual requirements. The factor may, moreover, vary according to the paper used in making the preliminary test, although it would appear that bromide and gaslight paper take about the same time to blacken up.

This method compensates for variations in the strength of the developer, the activity of its constituents and the temperature.

For ordinary purposes, the test slip should take not less than about 10 seconds or more than about a minute to blacken up.

Mr. Alfred Watkins, in comparing this method with the test-slip method suggested by him some years ago, considers the new method an improvement, as it involves less preparation. He prefers to use gaslight instead of bromide paper.—“B.J.,” September 4, 1908, p. 676.

STAND (TANK) DEVELOPMENT.

Stand Development.—Wratten and Wainwright, in a circular on stand development, point out that dilution of a developer with, say, ten times its volume of water, does not necessarily mean that the same results are obtained in ten times the period of development as are obtained with the full strength solution. In the case of rodinal, glycin, and pyro-soda, it was found that the time for complete development was longer than that which would be required if the

developer had followed the rule above suggested. Thus, a plate developed for three minutes in 1 in 20 rodinal required, in 1 in 200 rodinal, not 30 minutes but 42 minutes. This, if the developer was as free as possible of air. Diluted with ordinary distilled water, the time was 46 minutes, while, with ordinary tap water, it was 53 minutes. Glycin and pyro-soda were found not to be sensitive to air in the water, but did not follow the rule of dilution, a dilution of ten times requiring fifteen times the period of development for the same result as the full-strength dilution.

It is pointed out that in many tanks the plates are too close together during development, and too close to the bottom of the tank, with the result that development takes place more rapidly in the half-tones and shadows than in the high-lights of the plate, which are thus flattened in tone. This is due to the plates being partially starved of developer. Markings on the lower edge of the plate may be caused by backing falling to the bottom of the tank and there accumulating at the lower edge of the next plate. This can be prevented to some extent by placing plates in pairs back to back in the grooves of the tank—"B.J.," Nov. 15, 1907, p. 864.

A. Mackie, in pointing out the two great advantages of tank or stand development, namely, the saving of table space by placing plates upright in a tank, and the avoidance of the necessity of rocking during development, commends the system also for its economy of developer in comparison with dish development with full-strength solution. He regards the calculation of development time with a diluted solution from that with the full-strength solution as of minor importance, since photographers, as a rule, whether developing in a tank or not, remove the plate when, according to their judgment, development has reached the proper stage.—"B.J.," Dec. 6, 1907, p. 919.

Messrs. Wratten and Wainwright point out that their objection to rodinal applied only to development by time as advisable in the case of panchromatic plates.—"B.J.," Dec. 13, 1907, p. 950.

Developing Tanks.—F. W. Branson has patented a tank, or trough, the section of which is a trapezoid, a form which ensures the plate being placed in its lifter at one side (the wide) of the trough, its sensitive surface thus facing the bulk of the developer. Moreover, the plate cannot come in contact with a wall of the tank, and the insertion and withdrawal of the plate is more easily done. Eng. Pat. No. 13, 650, 1907—"B.J.," April 24, 1908, p. 331.

SELF-DEVELOPING PLATES

Self-Developing Plates.—Thomas Bolas has taken out a patent for a dry developer to be applied to the back of the plate or used as a separate sheet. In addition to claiming the distribution of different portions of the developer in different parts of the area, the use of hydroxylamine and an ammonium salt is named, also the use of acid sulphite and the use of bicarbonate as an alkali.

The acid constituent A may contain the reducing agent:—

Metol	1 gr.
Hydroquinone	2 grs.
Milk sugar, mannite, and other sugar-like preservative	1½ grs.
Bisulphite of soda or a bisulphite	1½ grs.
Starch partly boiled and partly in grains	6 grs.
Water in sufficient quantity to give a paint-like consistency on a thorough incorporation or grinding of the ingredients.	

Instead of metol and hydroquinone, other reducing agents may be employed.

The alkaline accelerator B may contain the following ingredients:—

Carbonate of soda or bicarbonate of soda	10 grs.
Gum arabic	2 grs.
Water in sufficient quantity to give a paint like consistency to the mixture upon grinding.	

The inert or slightly acid separating material C may contain the following ingredients:—

Sulphate of lime or sulphate of baryta	2 grs.
Gum arabic	½ gr.
Water in sufficient quantity to form a paint-like mixture on grinding.	

The above-mentioned quantities of A, B, and C respectively are such as are suited for coating a quarter-plate surface, or a surface measuring about 3 in. by 4 in.—Eng. Pat. No. 4,667, 1907; "B.J.," Nov. 29, 1907, p. 909.

DEVELOPMENT MISCELLANEA.

Two-solution Development.—P. von Joanovich recommends a system of development which consists in treating plates first in the No. 1 or developing solution for about half a minute, and then transferring them to the No. 2 or alkali solution. Total time of development is reduced by this plan, the principle of which is that the plate carries with it into the alkali solution only as much developer as can be taken up during the time of its immersion in No. 1, and hence over-development cannot occur. Solution 2 requires to be renewed after about every fifth or sixth dozen plates. The formulæ recommended are:—

I. Metol	5 gms.
Hydroquinone	5 gms
Sodium sulphite	100 gms.
Water	1,000 c.c.s
II. Potassium carbonate	100 gms.
Water	1,000 c.c.s

One advantage is that, if necessary, development can be done in total darkness. The system is applicable to all developers which work with an alkali.—"Phot. Korrr.," Oct., 1907, p. 505; "B.J.," Dec. 27, 1907, p. 980.

J. Peat Millar, in repeating the experiments of Joanovich, used two solutions, as follow:—

I. Pyro	½ oz.
Water	20 ozs.

II. Sodium carb. "cryst."	2 ozs.
Sodium sulphite	2 ozs.
Water	20 ozs.

and compared the results of developing identical exposures in a mixed developer and in No. 1 for one minute, followed by an immersion of the same time in No. 2. In the first case the plates required $6\frac{1}{2}$ minutes as against two minutes, the results being the same. It would seem that the method cannot give a hard negative, yet does not produce results which can be called flat. It should, therefore, be a useful method for beginners, who are advised to use a stronger No. 1 solution, or to use the same solution warmer if the negatives are too thin.—"A.P.," Jan. 7, 1908, p. 10.

Sodium Sulphite.—Examination of three samples of sulphite of soda from an ordinary shop—namely, the commercial—the re-crystallised and the anhydrous showed that in the first-named 94.5 per cent. of pure sulphite was indicated, the re-crystallised showed 96.25 per cent., and the anhydrous 84 per cent. From this it would appear that for photographic purposes it is not necessary to use the re-crystallised sulphite, which costs double the price of the commercial salt, a good sample of which should meet all requirements. The anhydrous salt compares unfavourably with the crystalline, probably on account of its not being absolutely free from water.—"B.J." (from "Pharmaceutical Journal"), Feb. 21, 1908, p. 150.

Remedying Uneven Density Due to Non-uniform Drying.—P. L. Anderson, after trying re-soaking in water in acid-alum, hypo, etc., without result, found that by bleaching the negative and re-developing with weak pyro soda the drying marks were eliminated. Development should be full in order to secure the evening-up of the negative.—"Phot. Times," Dec., 1907, p. 485; "B.J.," Jan. 3, 1908, p. 6.

Recovering Fogged Plates.—W. S. Davis recommends a bichromate solution for the bathing of fogged plates, or for rapid plates to be rendered slow and suitable for black-and-white work. The bichromate solution may be used in conjunction with a developer slightly dosed with bichromate, or the bichromate bath alone will serve:—

BICHROMATE SOLUTION

Potass. bichromate	10 grs.
Hydrochloric acid	5 minims
Water	4 ozs.

Plates are bathed for two minutes, washed for one or two minutes in running water, after which they may be given a bath of alcohol to accelerate drying.

To each ounce of a metol developer several drops of 10 per cent. bichromate solution containing twenty drops hydrochloric acid per ounce is added.

The process is useful where special slow contrast plates are used for copying, these being readily obtained by bathing and developing any rapid plates as above. Plates can be exposed while only surface dry—[Or the bath can be used after exposure.—En. "B.J.A."], —"Phot. Times," May, 1908, p. 139.

IXING AND HYPO-ELIMINATORS

Theory of Fixing.—The Lumière Brothers have found the solution of silver bromide and chloride in thiosulphate does not give the same double salts. In the case of silver bromide it may be assumed that the saturated solution contains a double salt composed of 5 molecules of silver bromide and 9 molecules of thiosulphate. This salt, which only exists in solution, precipitates, on evaporation or precipitation with alcohol, a double salt $\text{Ag}_2\text{S}_2\text{O}_3 \cdot \text{Na}_2\text{S}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$, which, in sufficiently concentrated solutions, is gradually decomposed into the double salt $\text{Ag}_2\text{S}_2\text{O}_3 \cdot \text{Na}_2\text{S}_2\text{O}_3 \cdot \text{H}_2\text{O}$, which is insoluble in water. In the case of silver chloride the hypo solution is saturated with a quantity of silver halide which exactly corresponds to the composition of $\text{Ag}_2\text{S}_2\text{O}_3 \cdot 2\text{Na}_2\text{S}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$, but the saturated solution deposits an insoluble salt of the formula $\text{Ag}_2\text{S}_2\text{O}_3 \cdot \text{Na}_2\text{S}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$. Finally, from this solution there can be isolated the two double salts, which can be separated in the case of bromide.—“B.J.,” Aug. 16, 1907, p. 614.

Alum-Hypo Fixer.—R. Namias, from experiments made to obtain a bath which should harden the gelatine film in the same time that it removed the silver bromide from it, has arrived at the following formula:—

Chrome alum solution, $1\frac{1}{2}$ per cent.	50 c.c.s.
Hypo solution, 50 per cent.	50 c.c.s.
Sodium acetate	$2\frac{1}{2}$ gms.

This bath was found the best of a number made up in all cases with sodium acetate, with and without acetic acid. The formula given above corresponds practically to a bath as follows:—

Chrome alum	24 grs.
Hypo	$1\frac{1}{2}$ ozs.
Sodium acetate	80 grs.
Water	7 ozs.

“B.J.” (from “Das Atelier”), Jan. 3, 1908, p. 5.

Ammonium Hyposulphite Fixer.—The Actien-Gesellschaft für Anilin Fabrikation has patented the use of ammonium hyposulphite alone or with sodium hyposulphite. Or the ammonium hyposulphite may be formed by using a suitable mixture of sodium hyposulphite and an ammonium salt, such as ammonium chloride or ammonium sulphate. 24.8 parts of crystallised sodium hyposulphite are dissolved in 50 parts of water, and 10.6 parts of ammonium chloride in 50 parts of water added. These two solutions are mixed together to produce the fixing bath, which is used in the usual manner.

A similar fixing bath is obtained by dissolving together 100 parts of water, 24.8 parts of crystallised sodium hyposulphite, 5.3 parts of ammonium chloride, and 6.6 parts of ammonium sulphate.—Eng. Pat. No. 25,869, 1906; “B.J.,” Dec. 6, 1907, p. 923.

MM. Lumière and Seyewetz, as the result of tests carried out with pure silver bromide and bromide papers, come to the following conclusions as to the advantage of forming ammonium hyposulphite in the fixing bath by addition of ammonium chloride:—

(1) Addition of ammonium chloride to hypo solution hastens the fixing of silver bromide plates and papers only when the proportion of the chloride to thiosulphate is less than 10 per cent.

(2) The proportion of ammonium chloride which exerts the maxi-

num of action as regards speed is distinctly less than the proportion theoretically necessary to form ammonium thiosulphate. If this theoretical proportion be exceeded the speed of fixing falls off.

(3) The solubility of the silver bromide in hypo is increased by addition of ammonium chloride if the strength of the thiosulphate is under 40 per cent. On the other hand, it is reduced if this strength is reached or exceeded.

(4) The compounds of the silver salts which are formed in a fixing bath of hypo and ammonium chloride are distinctly more unstable than those formed with pure hypo, and the degree to which a bath can be used is also distinctly less in the case of the compound solution.

(5) In spite of the advantages which a mixture of hypo and ammonium chloride possesses as a rapid fixing agent, it is believed that this method of fixing should be discarded, on account of the instability of the double salts, and the rapid changes which take place in the prints unless the washing is thorough.—"B.J.," May 29, 1908, p. 417.

HARDENING BATHS

The Hardening of Gelatine.—MM. Lumière and Seyewetz, as the result of examining the action of a large number of substances on gelatine, find that certain substances precipitate the gelatine, which re-dissolves on addition of cold water, whilst others produce precipitates insoluble in hot water. Others again render gelatine insoluble in warm water, but do not precipitate it.

The following were found to precipitate gelatine:—Phosphotungstic acid, or a mixture of phosphoric acid and sodium tungstate; phospho-molybdic acid, or a mixture of phosphoric acid and ammonium molybdate; chlorine water, bromine water, ferric salts (with the exception of the tartrates and citrates and the double salts with these acids), manganic and vanadic salts, ceric and uranic salts, gold chloride, platinum chloride, mercuric salts, and potass. permanganate.

A certain number of salts, including the carbonates, sulphates, nitrates, sulphites, bisulphites, and hyposulphites of the alkali metals, precipitate gelatine only when the solution is of sufficient strength. This is the case with solutions of 15 per cent, the action increasing with solutions of greater strength. Among such salts are the following:—Sodium carbonate, potass. carbonate, ammonium sulphate, sodium sulphate, potass. sulphate (the 10 per cent. saturated solution gives a slight precipitate), ammonium, sodium, and potass., nitrates, sodium sulphite, bisulphite, and hyposulphite.

Lastly, the salts of aluminium increase the viscosity of the gelatine solution without producing a visible precipitate.

The substances which precipitate gelatine only if they are employed in highly-concentrated solution are the carbonates, sulphates, sulphites, bisulphites, hyposulphites, and nitrates of the alkaline metals. This action differs from the preceding in the fact that the gelatine precipitated by the strong solution of an alkaline salt re-dissolves immediately on the addition of a sufficient quantity of water.

The compounds which render gelatine insoluble in boiling water are the salts of chromium, formaldehyde, and certain organic bodies,

such as quinone and quinhydrone. The action of these latter is given in the following table:—

PROPERTIES OF GELATINE RENDERED INSOLUBLE IN BOILING WATER BY SUBSTANCES WHICH DO NOT CAUSE PRECIPITATION OF GELATINE SOLUTIONS

Insolubilising substance.	Appearance of hardened gelatine.	Percentage of nitrogen in hardened gelatine.	Properties of insolubilised gelatine.		Smallest quantity of substance required to render gelatine (in solution) insoluble. Quantity for 100 grammes dry gelatine.
			Action of acids in cold.	Action of alkalis in cold.	
Chromium salts.	Greenish...	15.7	Decomposed with formation of chromium salt	Decomposed ..	Unaffected . . . 2 grms. of chrome alum = .304 gm. Cr_2O_3 .
Formaldehyde	Colourless	17.6	Decomposed with liberation of formaldehyde	Decomposed ..	Decomposed with liberation of formaldehyde
Quinone and its homologues	Light brown	17.5	Unaffected . . .	Unaffected ..	Unaffected . . . 1 gm. for solution above 10 p.c. of gelatine, 4 grms. for 5 p.c. gelatine solution
Quinhydrone	Brown	17.3	Unaffected	Unaffected .	As for quinone

—"B. J., Aug. 7, 1908, p. 602.

After-Treatment of Negatives.

INTENSIFICATION.

Chromium Intensifier.—C. Welborne Piper gives the instructions and precautions for the use of the intensifier worked out by himself and Mr. D. J. Carnegie:—Bleaching Solution—Potass. bichromate, 10 grains; hydrochloric acid, 5 minims; water, 1 ounce. Re-developer—Any good developer (amidol for preference) containing about 5 grains of amidol per ounce and no bromide. The commonest source of failure is the exposure of the bleached negative to strong light. Exposure also during re-development will produce stains at times. Too long an immersion in the bleaching bath or too much acid in it gives less intensification. The plate should be bleached until all greyness has disappeared from the back and washed until the yellow stain is gone; a brownish-buff image remains. Bleaching takes about two minutes, washing about twenty minutes, and development about five minutes. The whole process should be done in diffused daylight or gaslight, not sunlight; and much light during washing should be avoided. The bleaching solution is a powerful hypo eliminator, and the plates can be immersed in it after a brief rinse from the fixing bath, but by so doing the bleach is quickly exhausted, and the use of a second bath is advisable.—“B.J.,” Jan. 4, 1907, p. 3.

Stains with the Chromium Intensifier.—Neglect of the fact that developers frequently stain when used in the light is one cause of stains in the chromium process. The developer should never be used in sun or very strong light; soft, diffused daylight, or artificial light, involves no risk with fresh developer.

Too much exposure to light during the washing between bleaching and development is another cause, if not of stain, of irregular action due, say, to part of the negative being covered during the washing. This exposure also may lead to the gelatine becoming tanned or hardened, the silver image being solarised, and then refusing to re-develop.

A minor cause of stain is insufficient washing between bleaching and re-development. Improper fixing will, of course, cause a bad stain, but incomplete removal of the hypo will not, provided the bleaching solution acts long enough, or is used twice, since it rapidly destroys hypo.—“B.J.,” Nov. 22, 1907, p. 879.

Mercury Intensifier.—M. George Le Roy has recommended the addition of a little commercial hydrogen peroxide solution to the solution of mercuric chloride used for intensification. The mixture is found to possess greater activity and rapidity of action, and is able to bleach negatives which resisted the action of the plain or acidulated mercury solution, owing, it is thought, to imperfect fixation. The suggestion appears to be that the peroxide acts on the compounds in the film of the negatives which oppose the action of the mercury solution.—“Bull. Soc. Fr. Phot.,” July 1, 1908, p. 273; “B.J.,” July 10, 1908, p. 521.

Nitric Acid as Clearing Bath in Mercury Intensification.—R. Namias finds that the slight yellow stain which is apt to show itself often in patches in negatives intensified by bleaching with mercury and darkening with sulphite or ammonia, may be avoided by treating the plate, after bleaching, for ten minutes in a 1 per cent. solution of nitric acid, which apparently removes traces of the mercury salt which washing alone will not take from the gelatine film. In the case of ammonia, the stain does not show itself until after considerable exposure of the negative to light; when sulphite is used as the darkening agent the stain is much less and appears at once. The nitric acid proves effective as a remedy in this case also.—“Phot. Couleurs,” June, 1908, p. 159; “B.J.,” July 31, 1908, p. 580.

Copper Bromide Powder Intensifier.—The Act Ges für Anlun-Fabrikation has patented the making of a dry intensifier of this kind. Anhydrous (water-free) copper sulphate is added to sodium or potassium bromide, but in larger proportion than that of the combining weights. The mixture is a slightly coloured powder, which keeps well in tubes and dissolves readily in water.—Ger. Pat. No. 201,168, 1907.—“Chem. Zeit.” (Repertorium), September 9, 1908, p. 468.

Ozobrome Intensification.—W. Findlay recommends the use of the ozobrome process for the intensification of very thin negatives. Tissue, sensitised with the ozobrome solution, is squeezed in contact with the film of the negative, developed by the ozobrome No. 1 method, and the negative, which is bleached somewhat by this treatment, re-developed. It is stated that some “pigment tissues” of the Ozobrome Co. are unsuitable for the purpose; sepia is suitable.—“B.J.,” May 22, 1908, p. 394.

REDUCTION.

Pernanganate Reducer.—R. Namias has modified the preparation of the permanganate reducer worked out by him so that it can now be made up in a dry state ready for solution at the time of use. Instead of sulphuric acid, ordinary alum is used, its acid character being sufficient for the purpose. One-fifth of 1 per cent. of potass. permanganate is added to a cold saturated solution of alum—in other words, the reducer contains about 1 grain of permanganate and about 50 grains of alum per fluid ounce. Thus compounded, it is found to work better than the sulphuric acid formula, as it keeps well and does not attack the gelatine film. The alum-permanganate solution stains the gelatine a deeper brown than the acidulated bath, owing to the precipitation of manganese oxide; by the use of a 5 per cent. solution of sodium bisulphite this stain can be readily removed.—Eder's Jahrbuch, 1907, p. 107; “B.J.,” Jan. 3, 1908, p. 2.

Persulphate Reducer.—R. Namias and A. Baschieri have given the results of testing formulæ for the persulphate reducer, including that of H. W. Bennett (see “B.J.A.,” 1908, p. 638), in which

sodium sulphite is used with sulphuric acid. The authors have used different makes of persulphate, including one of German origin containing 53.2 per cent. of persulphate, another (French) containing 47.6, and a third of Kahlbaum, containing 96.8. In making up the Bennett formula, sulphurous acid was liberated, but no odour of sulphur dioxide remained after three or four days, the persulphate having oxidised the sulphur dioxide, and being thereby partially destroyed. The authors could find no advantage in the Bennett solution over a simple solution of persulphate, whilst the latter they found to be more permanent. It was found that a plain, neutral, or acid solution of persulphate, made in distilled water and protected from light, keeps in good condition for at least two months.—“B.J.” (from “Atelier”), Dec. 13, 1907, p. 940.

A Soft-Working Farmer's Reducer.—C. Welborne Piper has found that a mixture of ferricyanide and hypo, containing also potass. bromide, acted very readily and steadily as a reducer, and showed no specially selective action on the shadows of the negative. Its action resembles that of persulphate, but is less erratic than that reducer. A working formula consists of equal parts of potassium ferricyanide and potassium bromide (10 per cent. solutions) added in the proportion of a few drops to 2 ounces hypo solution (also 10 per cent.)—“B.J.,” April 24, 1908, p. 219.

F. F. Renwick points out that a similar effect is obtained if the ferricyanide be applied first alone, followed, after a short washing, by the hypo bath. The details are not cut away, and the highlights are fully reduced.

A. Edwards confirms Mr. Piper's observation, and finds that the same effect is obtainable by adding ammonia to the Farmer's reducer. Ammonia and potassium bromide together in the reducer have proved a useful formula.—“B.J.,” May 1, 1908, p. 349.

Reduction by Re-development.—The use of a bleaching solution and cautious re-development may be adopted as a reducing method successfully, particularly for negatives which are very hard in contrast. This old method of Eder is easily practised by using a mixture of bichromate and hydrochloric acid and re-developing slowly, say, with amidol containing 4 grs. of bromide per oz. If the development is conducted in a white porcelain dish, watched carefully, and stopped when the plate has apparently just regained its original density, it will be found on removing the plate from the dish and looking through it that it is very much thinner than it was originally, even though the image is blackened right through to the glass. If fixed at this stage the result may be too thin, and it is generally necessary to carry development a little farther. If reduction is insufficient it can be repeated, or if carried too far it can be remedied by intensification. No detail is lost in the process, and all gradations are preserved if slow development right through the film is ensured. A hard negative can easily be converted into a beautifully soft one without the slightest risk of damage, and this method of reduction is one of the greatest possible value.—“B.J.,” April 17, 1908, p. 298

STRIPPING NEGATIVES.

Stripping Glass Negatives for Storage of Films.—John Sterry recommends for the storage of negatives which would be destroyed unless some lighter support than glass could be found for them, the following process. The negatives are immersed for thirty minutes in—

Potass. carbonate saturated solution	... 2 ozs. by measure.
Glycerine	... 1 oz. by measure.
Formaline	... 1 oz. by measure.
Tap water	... 50 ozs. by measure.

This mixture is cloudy soon after making, and must be either filtered or decanted from the sediment. The plates after immersion are stood to drain for a few moments, and the solution mopped off them with an old soft handkerchief made into a pad. They are then put aside, where they will dry slowly and uniformly, requiring, as a rule, at least six hours, and better twelve or more. To strip them, all that is then necessary is to cut round with a sharp knife about 1/16th in. from the edge of the plate, when on lifting one corner the film will separate easily, and lie perfectly flat. Longer immersion in the mixture or more formaline added causes the edges of the films to separate and curl up. A greater proportion of formaline so hardens the film that it splits on drying. Artificial heat makes the stripping irregular, or the plate may refuse to leave the glass. The remedy is to allow the plates to stand where they can absorb moisture before stripping. The process is of no use for stripping negatives on celluloid film.—“Phot.,” Feb. 4, 1908, p. 100.

RETOUCHING NEGATIVES.

Retouched Negatives for Enlargement.—See under “Enlarging.”

Retouching Medium.—A. T. Hall recommends the following as a formula for a medium which dries rapidly with a smooth, hard surface:—

Pure American turpentine	1½ ozs.
Oil of spike	½ oz.
Pale resin	1 oz.
Raw linseed oil	8 minims.
Terebene	20 minims.
Essence of pear	¼ oz.

The two latter are used for their quick drying propensities. If the solution is too thick, it may be diluted with more turpentine. Only the least possible amount is required to be spread over the negative, on those parts to be retouched, and it is best applied with the fingertip.—“B.J.,” May 22, 1908, p. 407.

Blocking Out Negatives.—Readers of “Process Work,” in response to a request for an equally satisfactory but less costly stop-out medium than the Vanguard “Photopake,” have given some formulæ, while not confirming the querist’s view as to the expense incurred by using “Photopake.”

Methylated spirits	... 4 ozs.
Gum sandarac	... 2 ozs.

Dissolve as much of the gum as possible (there will be slight residue), and add lamp black to make a liquid of suitable consistency.

Another is:—Add methylene blue (about as much as will stand on a sixpence) to 1 oz. of pure alcohol, and dissolve by shaking. Prepare at time of use.—“B.J.,” July 10, 1908, p. 531.

Packing Negatives.—W. J. Casey, the manager of Raines and Co., enlargers, of Ealing, gives the following as his firm's experience in the safe packing of negatives. For a half-plate negative a box with sides $\frac{3}{8}$ of an inch thick and top and bottom $\frac{1}{4}$ in. thick is necessary, the negative to be surrounded with something to deaden vibration, such as wood-wool or cotton-wool, or at a pinch crumpled paper. When packing several negatives in one box they must be so placed that the smaller negatives do not exert any uneven pressure on the larger ones. If, for example, a $\frac{1}{4}$ -plate has to be packed with two $\frac{1}{2}$ -plates, it is obvious that if packed in between them it will at once act as a fulcrum on which the negative above can see-saw. And see-sawing is most decidedly not advisable where glass is concerned. The best plan is, under such circumstances, to place the two $\frac{1}{2}$ -plates film to film, and then, on top of them, a piece of card of the same size. The weight of the $\frac{1}{4}$ -plate negative resting on the card is then distributed evenly over the $\frac{1}{2}$ -plates.—“P.N.,” Dec. 6, 1907, p. 538.

Reproducing Negatives.

Enlarged Negatives Direct by Reversal.—Jos. Maes gives the following practical instruction for the making of an enlarged negative by direct enlarging of a smaller one by means of a modification of the old reversal methods revived by the introduction of the Autochrome plate. The developer used is amidol, which is allowed to act for about one minute, producing a rather flat positive transparency. After washing out the developer thoroughly, the print is brought into the light for a few seconds, using daylight or that of an incandescent burner, the time of exposure in the latter case being from 30 to 60 seconds at 8 to 12 ins. distance. At this stage the white film becomes slightly grey and tinted; in the case of platino-bromide papers the tint will appear faintly violet. This need give no cause for anxiety, but is, in fact, a condition for successful results. Exposure having thus been made, the further work is proceeded with in the dark-room. The print is placed in the following solution:—

Potass. bichromate	15 gms.
Nitric acid	6 c.c.s.
Water	500 c.c.s.

As soon as the plate has been covered with this solution, the positive image springs out for a moment, the reduced silver is dissolved from it, and at the end of a few minutes disappears completely. The silver image is converted into silver chromate.

The print is then thoroughly washed, to remove the salts of chromium; or instead of a rather protracted washing the following solution is used:—

Sulphite of soda, anhydrous	100 gms.
Bisulphite of soda solution	20 to 25 c.c.s.
Water	500 c.c.s.

Five minutes' immersion of the print in this bath will completely remove the chromium salts, after which it is washed in several changes.

The plate or paper print is then again covered with the amidol developer used in the first instance. It reappears at the end of thirty seconds as a negative, which gains density somewhat slowly, and obtains sufficient intensity in ten to fifteen minutes. It is necessary to continue development up to a point when the image appears fogged and somewhat too vigorous, and then, after washing, the print is fixed in an acid fixing bath in the usual way, washed, and dried.

The paper negatives can be rendered transparent by the usual methods—"Bull. Belge," Feb., 1903, p. 58; "B.J.," March 20, 1908, p. 215.

C. R. M. Parr recommends the following procedure of M. Balagny for preparing enlarged negatives on plates and negative paper direct from a small negative without the production of a transparency:—

The original negative is enlarged on to an ordinary slow plate, and developed with—

A. Amidol	15 grs
Sodium sulphite	80 grs.
Ammonium bromide, 10 per cent	2 drams.
Potass. metabisulphite	5 grs
Water	5 ozs.

Development is stopped when the image shows through at the back of the plate.

Assuming a good positive has been obtained, it is washed for five minutes, backed with a piece of wet black paper to prevent halation, and exposed to daylight for 30 seconds, or 6 in. of magnesium ribbon is burnt one foot from the plate.

All subsequent operations are conducted in the dark-room, in a good yellow light. After exposure the plate is bleached in—

B. Potass. bichromate	75 grs
Nitric acid	30 minims
Water	5 ozs.

and after the action is complete immersed in—

C. Sodium sulphite	1 oz
Potass. metabisulphite	15 grs.
Water	5 ozs.

This solution will clear the bichromate stain from the film in about five minutes, when the plate is well washed and redeveloped in—

D. Amidol	15 grs.
Sodium sulphite	80 grs.
Potass. metabisulphite	15 grs.
Water	5 ozs.

until the image is black enough, and, finally, it is fixed and washed in the usual way.—"Journ. of Birmingham Photographic Society"; "B.J.," Nov. 8, 1908, p. 846.

Enlarged Negatives Direct.—Rev. F. C. Lambert advises the following procedure for the making of enlarged paper negatives direct from negatives. Using Ilford "Smooth Slow" bromide paper, the

positive image obtained in the ordinary way is developed with rodinal 25 minims, potass. bromide $\frac{1}{2}$ gr, water to make 1 oz. Development should be full (until the highest lights can be fairly seen on the back of the paper), after which the print is rinsed, placed in saturated solution of potash alum for a few minutes, and then treated in the following reducing bath:—

Potash alum (saturated solution) 2 ozs.

Sulphuric acid, 20 per cent solution 1 dram.

Potass. permanganate solution, enough to give mixture port-wine colour.

This bath is made up fresh for each print. Any stain is removed in weak solution of oxalic acid. After a further wash of five minutes the print is laid flat on the bottom of a dish and exposed to the light of a gas burner for, say, 30 seconds at 1 ft. The developer first used is then again applied, and if no image is produced at the end of a minute a second exposure is given to the gas burner, which latter is kept burning and, at a distance, gives sufficient light to assist the development of the negative image. The print is then fixed in an acid bath.—“Phot. Scraps,” Oct., 1908, p. 270.

Paper Negatives Direct by Reversal.—W. Morrison advises the following method for paper negatives:—Expose from the negative to be reproduced in the usual way by contact or in the lantern, and develop as far as can be done without fog. Rinse in water and place in chrome alum bath, after which transfer to the sulphide bath usually used in sulphide toning, until the action of the latter is complete. The paper is then washed free from sulphide, and the original developed image bleached out with any convenient solution, such as the ferricyanide-bromide, being finally fixed in strong hypo.—B.M., Oct., 1908, p. 191.

For the simplified reversal method of Carnegie see under “Lantern Slides.”

Film Photography.

NEGATIVES ON FLEXIBLE SUPPORTS.

Non-Halation Roll-Film.—The firm of Lumière, of Lyons, has patented a double film sensitive on one face and non-actinic on the other, which is prepared by applying some soluble coating such as gum arabic, sugar, or glucose, to a film of gelatine or collodion which has been rendered non-actinic by addition of a pigment, and permeable by water by addition of glycerine or gum. This first layer or film forms the support, and the material constituting the usual photographic film is applied to it, a positive or negative emulsion being finally coated. When the whole is perfectly dry, the compound film is stripped from the rigid surface, which has been used when preparing it. After the exposure of the roll-film or plate, it is sufficient to immerse it for a few seconds either in ordinary water or in any suitable aqueous bath. The liquid penetrating through the non-actinic colloid layer, which is permeable, softens and dissolves the agglutinant so that the two portions of the film easily separate. There is then left the ordinary transparent film, which can be subjected to all the usual developing and printing operations.—Eng. Pat., No. 7,132, 1907.—“B J.,” Dec 6, 1907, p. 923.

V.—PRINTING PROCESSES.

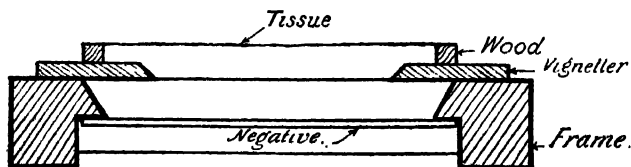
POSITIVES DIRECT.

Restoring Tarnished Daguerreotypes.—W. E. Debenham publishes details of a process used by him since the era of Daguerreotype. The tarnish or iridescence is removed with pure hydrochloric acid. Holding the Daguerreotype as horizontally as may be over a sink or basin, enough hydrochloric acid is poured on to cover the plate. The iridescence disappears almost instantly, and the plate is then washed, first with ordinary, and finally with distilled water. In the course of washing, the plate may be taken in the hand while the ends of the pliers are rinsed to get rid of any acid held between them and the plate. The plate should be dried in such a way that the moisture disappears from one side or corner to the opposite in one sweep without halt or stoppage. To secure this, hold the plate over the flame with the corner held by the pliers slightly lower than the opposite corner. As soon as one corner begins to dry, hold the plate nearly upright, still keeping the plier side low, and if the plate is of the right heat the drying will continue without stopping, in an even wave from top to bottom. If the drying becomes so slow that there seems a danger of a halt (which might give rise to a line), make it hot from the top downwards, or assist the drying by blowing, or do both until dry all over. The object of the distilled water is to prevent the deposition on the plate of traces of the lime and other salts contained in ordinary water, but the distilled water should be examined by being held up to the light, and if there are any floating particles they should be removed by filtration.—“B.J.,” July 24, 1908, p. 560.

Bromide Positives Direct in the Camera.—For details of the Carnegie process, see under “Lantern Slides” and “Bromide and Gaslight Papers.”

Printing Methods and Accessories.

Vignettes by Electric Light.—T. E. Stagg maintains that the best method of printing vignettes by the arc light is by placing the ordinary vignetter in front of the printing frame, containing negative and paper, and fixing a piece or two of tissue paper or thin linen in front of this, supported on two pieces of wood about $\frac{1}{4}$ in. thick, fixed to vignetter, thus:—



The frame need not be moved round, and it prints in about ten minutes. At 10 in. from the arc lamp you can get a circle of six half-plate frames, and work them three deep, making eighteen frames round the light.

Another method is to place the ordinary vignetter in front of the frame containing the negative and paper, to hold same to lamp, and to turn it continually round. This method prints in about four minutes, and any boy can work it.—"B.J.," Jan. 31, 1908, p. 94.

AGAR-AGAR EMULSION PAPERS.

Agar-agar Emulsion.—W. F. Cooper and W. H. Nuttall, in a lengthy paper, have described the properties of agar-agar as a vehicle for the sensitive salts in making an emulsion paper. The agar also lends itself to the making of emulsion for plates, but most of the authors' work has been devoted to agar as a medium for a paper emulsion. To anticipate their general conclusions, the cheapness of agar is no inconsiderable item, the cost being less than gelatine, and only about one-eighth the amount being used. Its insolubility in water under a temperature of 80-90° C. enables very hot water to be used in washing; at the same time, prints can be dried with extreme rapidity over a naked flame. Certain chemicals can be used in agar which cannot be added to gelatine, such as platinum chloride. The pellicle of agar is much thinner than that of gelatine—about one-eighth the thickness—so that toning, washing, and other manipulation can be carried out much more quickly.

After giving references to the chief chemical papers on agar the authors state that in conjunction with P. Gillard they commenced to work out a self-toning agar paper. Mr. Gillard, at the time he joined them, had previously worked at an agar paper, the failures in regard to which are stated by the authors to be chiefly—

1st. The agar solution was not clear, containing small granules.

2nd. In making the emulsion one found that it would become thin and limpid, and would not set.

This second fault would occur, sometimes in making the emulsion, sometimes when made and whilst coating; sometimes it went limpid as a whole, while at other times it occurred in parts, causing a peculiar granular appearance.

3rd. Agar does not dissolve in water, unless heated to 212° F., i.e., the temperature of boiling water.

4th. If cooled to 90° to 95° F. it sets very quickly, and then will not dissolve again unless boiled once more; if this be done with an emulsion it is often quite spoilt.

5th. When he added his gold chloride to the emulsion, it was necessary to get it on to the machine without a moment's delay, otherwise the gold was reduced to the metallic state before the emulsion was on the paper.

The authors' work was undertaken to overcome these difficulties. They place agar chemically among the gums, as it yields mucic acid on oxidation. To dissolve the agar it must be cut up into small

pieces, soaked in running water for some hours, placed in distilled water, the latter heated to boiling, and the boiling continued for a quarter of an hour, stirring vigorously the whole time. Solution not boiled long enough will be "lumpy," that is, contain undissolved agar and be more difficult to strain.

Agar may be dissolved by soaking in 1 per cent. acetic acid solution for twenty-four hours, the acid washed out in running water, and the agar dissolved by boiling. The treatment has no ill effect. A 2 per cent. agar solution can be conveniently made, though 1 per cent. is most convenient and 3 per cent. difficult to use. The solution is filtered as hot as possible through a Buchner funnel by aid of a pump and placing the flask in hot water. The solution is quite clear and transparent, and possesses the following properties, in regard to which it should be noted that the age of the agar seems to have some effect on its properties:—The solution sets at about 91° to 95° F., and more rapidly than gelatine. Its gelatinising property is about eight or ten times as great as gelatine. An agar solution can be boiled for a long time, an hour or more, without becoming less viscous. If not stirred, the solution "burns" and then produces a dirty emulsion. As agar contains no nitrogen, it cannot form any glyccoll compounds, as gelatine does, and hence emulsions are less liable to spoil from this cause. Protracted extraction of agar with cold water washed out 18 per cent. of soluble matter. Air-dried agar usually contains about 21 per cent. of moisture, driven off at 212° F., and the percentage of ash was found to be .487 per cent. in one sample. As a substitute for gelatine in an emulsion 1 to 1½ per cent. of agar should replace the 8 to 10 per cent. (which is the average for three formulæ of gelatine P.O.P. quoted by the authors, who recommend 2 ozs. of agar to the gallon). Thus in using such an agar emulsion the amount of silver per square foot will be the same, but the medium will be present in only one-eighth the quantity compared with gelatine. The authors suggest that the thin film would perhaps give plates of greater rapidity, latitude, and fine grain. They found that an emulsion ripened by being plunged in boiling water for five minutes had a speed of 65 H. and D.

Among other solutions which give no precipitate with agar solution are potass. chloroplatinite and gold chloride. Alcohol and tannin precipitate the agar. Alcohol added to the extent of about 40 per cent. precipitates a 2 per cent. ordinary dry-agar solution, whereas it would seem that to a solution containing 2½ per cent. of solid agar dried at 212° F. more than 40 per cent. alcohol may be added without decided precipitation. Agar solution poured into 90 per cent. alcohol forms a coagulum which can be collected on muslin and washed. Such precipitated agar contains much more ash, in one instance (probably excessive) 4.06 per cent. as compared with .487 per cent. On evaporating the alcoholic filtrate, a gummy mass was left behind, though whether of any photographic use is not known.

On boiling with acid or alkalies, agar has its setting properties destroyed, but the solid substance can be soaked in the cold with

dilute acid and alkalies without doing much harm, and may likewise be boiled with glacial acetic acid without much change, though it dissolves on heating if the acid is weak. One per cent. acetic solution, however, used as already advised for soaking has no injurious action.

Alkalies, in addition to reducing the setting power, make the agar solution rather more sticky and gummy, which effect is increased by borax, which makes the agar so sticky that it will draw out in strings some feet in length. Solution thus treated with borax sets much more slowly and to a more tenacious jelly.

Of iodine, agar absorbs a little, and of bromine, 1.65 per cent., against 6.21 of gelatine at 60° F. Contrary to what might be thought from this fact agar gives a fairly fast emulsion with scarcely any maturing.

Silver nitrate forms no precipitate with agar, but a hot mixture of the two darkens in colour (prevented by hydrogen peroxide and, less actively, by citric acid).

Chromic acid and potassium bichromate do not act with agar as with gelatine, nor do alum and formaline, the last serving as a means of extracting gelatine from a mixture with agar.

From measurements of the viscosity of agar solution, the authors show the de-gelatinisation which takes place on treatment with acids and other substances. As the curve shows, in ten minutes with nitric acid of decinormal strength the solution is only 72 per cent. as viscous; in twenty minutes it is 64 per cent., falling to 11 per cent. in one hour, and finally to 8 per cent. of its original viscosity.

Tartaric acid (decinormal) causes the solution to become only about 69 per cent. as thick, in twenty minutes: in time (about two hours) it will be 23 per cent. as viscous.

The curve for acetic acid, normal, is very erratic, but the acid certainly has a considerable effect.

Citric acid (decinormal) has a small degelatinising effect, and even after one hour it reduces the viscosity to no more than 80 per cent.

The effect of silver nitrate, normal, is marked at first, but after ten minutes there is not much alteration. The manner in which the line rises after a lapse of time is curious. The same peculiarity occurs in the curve for sodium hydrate.

Sodium hydrate, normal, has a very considerable degelatinising power.

Sodium chloride has no effect whatever. Ammonium chloride, however, makes it more viscous, and in thirty-two minutes the solution has become 8 per cent. "thicker." It gradually becomes less viscous, and in about eighty minutes it returns to its initial viscosity.

Borax causes great increase in viscosity, making it difficult to obtain measurements. These results show that free tartaric or nitric acid, or substances producing them, in an emulsion should be avoided. Rochelle salt, used by Mr. Gillard, acts similarly to

tartaric acid in causing degelatinisation. The authors' conclusions as to the defects of the Gillard emulsion are as follows:—

1. The opacity was due to incorrect manipulation, and can be overcome by filtering the solution of gelose at a strength of about $1\frac{1}{2}$ per cent.

2. The degelatinisation is due to the presence of certain chemicals in the emulsion, either added or formed by the reactions in emulsifying. As just shown from the viscosity measurements, it is advisable to use citric acid in preference to others in order to make the paper keep. If tartaric acid is required in an emulsion, then the emulsion should be made very much thicker at first, so that the tartaric acid may reduce the viscosity to the required degree.

3. The difficulty of solution causes no trouble except in washing emulsions. Emulsion which has been set and washed can be re-dissolved.

4. The setting of the emulsion is due to careless manipulation. In pouring from one vessel to another, the second vessel must be heated to about 40° C. In coating, also, the same point must be noted.

The reduction of the gold chloride was due to using the salt, which reduces the gold most easily. In P.O.P. emulsions there is excess of silver nitrate over the amount necessary to form the silver haloid, and this makes the reduction take place more easily.

The authors conclude by giving dimensions of apparatus for the rapid drying of agar-coated paper.—“Phot. Journ.,” Jan., 1908, p. 11; “B.J.,” Jan. 24, 1908, p. 62.

In the course of some editorial comments on the above paper attention is drawn to the fact that when using solutions of agar and gelatine of equal “thickness,” the former has by no means such salt-holding powers as the latter—that is, given a somewhat heavy percentage of salts in the same bulk of solution they will show surface crystallisation much more readily with agar than with gelatine.

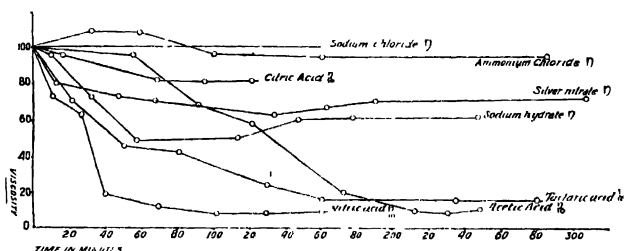
It is mentioned that uncoated emulsion made with agar certainly shows less tendency to spoil than ordinary P.O.P. emulsion.—“B.J.,” Jan. 31, 1908, p. 79.

The authors, in replying to the above, instance a case of the rapid maturing of agar emulsion in which a speed equal to Nikko paper was obtained with an agar bromide emulsion in five minutes at 100° C. The authors find that papers ordinarily used for emulsions are liable to give bubbles on toning in the case of an agar emulsion, and a resin-coated paper is therefore preferred.—“B.J.,” Feb. 7, 1908, p. 109.

Agar P.O.P. and Resin-sized Papers.—W. F. Cooper has patented the application of agar emulsion to non-coated papers which are sized with resin. The paper, without baryta or other coating, is treated with neutral resin size or acid resin size, such as that of C. Beadle or Wurster, on which the agar emulsion is coated.

In some cases it is advisable to add borax or alcohol, or both combined. The effect of borax on the solution is peculiar, producing a tackiness or stickiness and a peculiar consistency which is of

advantage in the operation of sizing or coating. Alcohol has the effect of causing the emulsion to spread better and to decrease the so-called "grease spots."



The emulsion is quick setting and quick drying, and thus is not liable to sink into the paper or to remain for any time in such a state in which the chemicals can "wander" into the body of the paper.—Eng. Pat. No. 2,156, 1907; "B.J.," Jan. 24, 1908, p. 68.

Agar-coated Raw Paper.—In a later patent W. F. Cooper claims the use of a mixture of agar solution and baryta or other pigment as a means of coating raw paper which is afterwards to receive an agar emulsion.—Eng. Pat., No. 2,156, 1907; "B.J.," Feb. 28, 1908, p. 163.

GELATINE AND COLLODION P.O.P.

TONING GELATINE P.O.P.

Theory of Warm Tones.—R. E. Blake Smith, in a paper on the theory of toning P.O.P., comes to the conclusion that all red and purple tones on P.O.P. consist of a "lake" containing silver sulphide and silver chloride. He points to the fact that combined baths and baths made up with thiocarbamide give the reddish tones best, whilst others, such as ammonium sulphocyanide, phosphate, and formate, frequently cannot be made to give red tones at all. He ascribes yellowing of the whites of P.O.P. prints after keeping to "retained" lead or silver, the former derived from the combined bath. This latter should be used so as to avoid the retention of lead or silver by the print, which in every case ought to be first washed and then fixed in neutral, or, better still, a slightly alkaline hypo.

Hypo	1½ ozs.
Sodium carbonate (cryst.)	20 grs.
Water	10 ozs.

The print should then again be washed well and then put into the toning bath. This method of working will prevent the acid solution of hypo taking up too much silver.

Lead, if added to this bath, should be added only in comparatively small quantity. The following combined bath is suitable:—Dissolve 1½ ozs. of hypo and 45 grains of alum in 6 ozs. of boiling

water, stirring until all has dissolved. Then allow this solution to stand till cool, and then add 4 grains of powdered lead acetate. This solution should be allowed to stand twenty-four hours, and is then filtered. To the filtered solution 1 oz. of the following gold solution:—

Gold chloride	1 15-gr. tube
Water	7½ ozs.

is added, and the bath is ready for use as soon as the gold colour has disappeared.—“B.J.,” Feb. 21, 1908, p. 140.

Hypo-Alum Toning of P.O.P.—R. Read finds an old hypo-alum toning bath very suitable for the toning of over-printed P.O.P. postcards, which are removed early from the toning bath, and, after fixing—when they are seen to be red—are put in the cold hypo-alum bath in which they will assume, in an hour or so, a good purple tone.—“Focus,” April 22, 1908, p. 381.

Thiomolybdate Toning of P.O.P.—Harry E. Smith finds that the thiomolybdate method (see Bromides—Sulphide Toning) is very suitable for P.O.P., giving warm tones closely resembling those obtained with gold. The print is fixed before toning, and therefore requires to be printed somewhat deeper. It is thoroughly washed, bleached in the “Cubrome” solution, and “toned” in the thiomolybdate. After a brief rinse a bath of 3 to 5 per cent. ammonia is used to clear the whites, and the prints are finally washed for fifteen minutes. There is no need to wash prints before fixing.

The process can be used with gelatine and collodion P.O.P., also with albumen and plain salted papers. It has no effect on prints on self-toning paper, and none on prints toned with gold or platinum, or made on platinum paper. With gelatine P.O.P. the tone is a rich purple brown; with collodion it is more nearly black, and with this paper printing needs to be done only a little deeper than for gold toning.

Prints can be fixed in 5 per cent. ammonia, if plenty of bath, or three successive baths, are used, but hypo toning is preferable.—“Phot. Journ.,” June, 1908, p. 267; “B.J.,” June 26, 1908, p. 490.

Reducing P.O.P.—R. Namias, whilst pointing out that any method of reducing a much over-printed P.O.P. may result in altering the relative tones in the print, gives the following formula:—

Common salt (sodium chloride)	100 gms.
Hydrochloric acid, commercial	20 c.c.s.
Water, enough to make	1,000 c.c.s.

The prints are placed direct in this bath, where they are left for from five to ten minutes, being then rinsed and toned in a combined toning and fixing bath. This solution will not produce great reduction; it can be rendered more active by adding

Copper sulphate ½-2 gms.
With this addition the bath is best used after the prints have been toned.

If the prints are to be separately toned and fixed, the following solution can be made up as a combined toning and reducing bath :—

Gold chloride, pure	1/2 gm.
Common salt (sodium chloride)	10 gms.
Hydrochloric acid, commercial	5 c.c.s.
Water, to make	1,000 c.c.s.

This bath tones and reduces the prints at one and the same time. If the resulting tone is not satisfactory, the print can be transferred to a normal toning bath of gold and acetate after it has reached the right degree of vigour in the bath given above.—“Phot. Couleurs,” July, 1908, p. 172; “B.J.,” August 7, 1908, p. 600.

Glazing P.O.P. Prints.—J. de Voil recommends the following procedure for glazing gelatine prints by stripping from glass. After washing the prints thoroughly from free silver (in the case of P.O.P.), place them in an alum bath of 8 ozs. to 80 ozs. of water. In this they remain ten minutes, and are then washed and toned in the usual way, drying them completely before passing to the glazing process. The plate glasses for this latter are prepared as follows. A small piece of cotton wool is well soaked with methylated spirit and the glass cleaned with this, rubbing over with a clean cloth. In wetting the cotton wool with spirit simply hold the wool to the neck of the spirit bottle, give the latter a shake, and clean the plate with the quantity of spirit thus absorbed. Then French chalk the glass and rub clean with another cloth. Water from the tap is now allowed to run all over the glass two or three times, and without wiping, but straight from the tap the glass is placed handy for the prints to be placed on it. These are then squeezed firmly down and left to dry. The secret lies in letting the tap run on the glass after polishing with French chalk.—“B.J.,” Feb. 7, 1908, p. 110.

DEVELOPING P.O.P.

Silver-Phosphate Emulsion.—York Schwartz has improved the process of preparing a silver-phosphate emulsion patented in 1902 (Pat. No. 9,993). In making the emulsion a quantity of phosphate is mixed with the whole quantity of silver, such that insoluble phosphate of silver is formed, chloric acid and an organic acid being also present in the emulsion.

In presence of colloidal substances, preferably gelatine, a considerable excess of alkaline phosphate, preferably phosphate of sodium, is mixed with nitrate of silver. It has proved best to use double the quantity of alkaline phosphate, which would be necessary to convert the silver nitrate into silver phosphate. To this mixture chlorate of potassium and citric acid are added, and, for the purpose of rendering the photographic film more resistant, it may be desirable to add further a small quantity of chrome alum. Owing to the great excess of alkaline phosphate the whole amount of silver in the emulsion must be present in form of insoluble phosphate.

Experiments have proved the emulsion to be so sensitive that

it may be used also for enlarging purposes and even for negative-making. The best developer for this emulsion is a simple aqueous solution of metol. The pictures show great intensity and brilliancy and very nice tones, and furthermore great permanence. By adding sulphite of sodium to the aqueous solution of metol the rapidity of development is so increased that it takes place nearly instantaneously, the development in this case being a chemical one. Eng. Pat. No. 9,855, 1907.—“B.J.,” Nov. 1, 1907, p. 829.

P.O.P. for Physical Development.—York Schwartz has worked out a printing-out paper suitable for development by the method of J. H. Mallabar, in which a sulphocyanide is used. (See “B.J.A.,” 1907, p. 784.) The tones obtainable resemble those produced by gold toning, whilst the paper is sufficiently rapid to be printed in a few seconds by incandescent gas or ordinary lamp-light, or to be used for enlargements. The tone obtained is affected by the degree of exposure, the longer exposure giving increased warmth of tone. The developer can be used repeatedly, and the finished print fixed and washed with great rapidity.—“B.J.,” March 20, 1908, p. 212.

Bromide and Gaslight Papers.

BROMIDE PAPERS.

Bromide Prints Direct in the Camera.—Douglas Carnegie finds that the process of obtaining positives direct by the reversal method given under “Lantern Slides” can be used with bromide paper, and permits of prints being obtained with satisfactory clearness of the high-lights. The most suitable variety of bromide paper is the “glossy,” and the only difference in treatment from that given for lantern-slides is in the exposure to light prior to the second development. A weaker light (equal to one candle) is placed 30 ins. distant from the print lying in the dish and allowed to act until the portions of the paper protected by the rebats of the dark-slide begin to darken. It is advisable to sulphide-tone the print, since the tone obtained on secondary development is not at all pleasing.—“B.J.,” Oct. 23, 1908.

Rapid Bromide Printing.—A writer in the “Bulletin of Photography” mentions the useful dodge of interposing a thin piece of celluloid between the wet negative and the bromide paper in order to get off prints immediately. The celluloid is rubbed down in contact with the negative and air-bells thus expelled.—“B.J.,” March 13, 1908, p. 198.

Acid Diamidophenol Developer.—(See Negative Processes—Developers.)

Local Glazing of Bromides by the Bromoil Process.—T. H. Greenall uses the bromoil process of C. Welborne Piper (“B.J.A.” 1908, p. 662) for applying a varnish to the image only of a print, and

not at all to the highest lights, just as in pigmenting in the oil process.

The fixed and washed bromide should be allowed to dry, otherwise blisters may appear in subsequent operations. It should not, however, be alumed or treated in a fixing bath containing alum. It is then bleached in Mr. Piper's bromoil bleaching solution, of which the following is the formula:—

Concentrated Ozobrome solution	.....	4 parts
10 per cent. potash alum solution	.....	4 parts
10 per cent. citric acid solution	.. ..	1 part
Water	.....	to make 20 parts

In about two minutes the black image should be completely changed to a faint brown one. The print is then washed, and either treated with sulphide solution, as in ordinary sulphide toning, or re-developed, in which case the final image will be black. The sulphiding solution consists of—

10 per cent. solution of sodium sulphide	..	25 minims
Hydrochloric acid (1 in 5 solution)	....	5 minims
Water	.....	2 ozs.

The hydrochloric acid must be added at the last moment before using, and fresh solution mixed each time.

The alternative re-developing solution must be fresh, and consist of—

Amidol	....	2 grs.
Sodium sulphite	... ..	20 grs.
Water	.....	1 oz.

After either sulphiding or re-developing, the print is just rinsed and then placed in sulphuric acid, diluted, 1 oz. in 20 ozs. of water, as in the bromoil process. (N.B.—Add the acid to the water and allow to cool before using.) In this bath the print is allowed to soak for twenty minutes or longer, and is then washed for ten or twenty minutes and dried; or it may be taken out for varnishing at once. The varnish consists of a few drops of Japan gold size and a touch (about one-fifth the quantity) of raw linseed oil, and should be mixed with an old table-knife on a piece of glass. This layer of varnish should be taken up with a china painter's dabber and applied therewith to the print. The highest lights will be found to repel the varnish, while the shadows will have an extra richness according to their depth. The work must be done before the varnish dries, but if this should occur before the high lights are clear, soap and water or a soft rag moistened with paraffin can be used to clean up the print. As in the oil process, gentle pressure with a charged brush puts on varnish; short, quick taps with an almost clean brush takes it off the high-lights and puts it on the image in proportion.—"A.P.," Dec. 10, 1907, p. 566.

GASLIGHT PAPERS.

Non-Abrasion Developer.—H. S. Hood recommends the following developer for both matt and glossy papers:

Metol	7 grs.
Hydroquinone	30 grs.
Sodium sulphite (dry)	110 grs.
Sodium carbonate (dry)	200 grs.
Potassium iodide	10 grs.
Potassium bromide (10 per cent. solution)	18 drops.
Water	10 ozs.

The chemicals should be dissolved in the order named. The developer should be used full strength. No additional bromide is necessary, as the solution contains all that is required for a properly timed print. If the tones are not all that they should be, the fault is due to either under or over-exposure. It is important that the developer and the fixing-bath should both be kept as cold as possible during the summer months. The temperature of these solutions has a direct effect on the colour of the prints. Warm developer gives brownish-blacks, while cold developer gives blue-blacks.

The formula avoids abrasion marks on the print, gives an improved tone, and acts as a guide to the printer as to the proper fixation of the print. When developed, the print is of canary-yellow colour, but in the fixing bath assumes a beautiful blue-black, this latter change taking place more slowly as the fixing bath becomes exhausted, and thus warning the printer that a new fixer should be made up.—“Photo. Times,” Oct. 1907, p. 423; “B.J.,” Nov. 23, 1907, p. 905.

Toning Bromide and Gaslight Prints.

SULPHIDE TONING.

Control of Colour.—C. Welborne Piper, basing his experiments on the colloidal nature of the sepia “sulphide” image, has worked out the following process, which allows of the colour being modified within a considerable range:—

Soak the bromide print in water until limp, and then immerse in the following solution:—

- A. 10 per cent. ammonium bichromate 5 oz.
 10 per cent. ammonium bromide..... 5 oz.

The dish must be kept rocking during this immersion, otherwise uneven markings will result, and to produce a cold sepia the time of immersion must be six minutes. Shorter periods give intermediate tones, but six minutes give as cold a tone as seems to be desirable. While the print is soaking, prepare for the next stage by taking 10 oz. of 20 per cent. potassium ferricyanide solution and adding to it 2 drachms of ammonia .880. No need to wash between the soaking and bleaching of the print.

When the time is up, pour off the A solution and add to it the solution of potassium ferricyanide. Rinse the print once or twice in water, and then bleach it in the modified solution. The result is not very light coloured. It is a fairly strong brown, but the action can be considered to be complete when the last trace of blackness has disappeared. Next, wash in running water for about ten minutes, and then tone for five minutes in a 5 per cent. solution of sodium sulphide. Pure sulphide from a reliable manufacturer should be

used, but it does not appear to matter whether it is of the crystalline or fused variety. The former gives a very slightly colder tone than the other, but that seems to be the only difference. The bromide prints should be fairly strong ones.

The method as above described is suited to the preparation of one print. If a number have to be toned, simply make up two separate solutions, one according to the formula A already given for the preliminary soaking bath, and a second one for bleaching. The formula for the bleach is then :—

B. 10 per cent. ammonium bichromate	5 oz.
10 per cent. ammonium bromide	5 oz.
20 per cent. potassium ferricyanide	10 oz.
Ammonia '880	2 drms.

Solution A can be used for a number of prints in succession. B will lose power in time, and will then have to be re-mixed, but it will serve for a long time if the prints are rinsed very slightly before bleaching. Apparently it is necessary to use a bleach of this or of very similar composition, and the bichromate in B seems to be quite as important as the bromide in A.

The bleaching of the print takes about two minutes. An alternative bleaching bath is obtained by adding 20 minims of strong nitric acid to 20 oz. of A solution. The final result is then a very rich brown tone, approximating to a warm sepia, when the preliminary soaking in A is six minutes. We can thus obtain either warm or cold sepias as desired, the exact colours varying with different brands of paper. —“B.J.,” August 14, 1908, p. 617.

Sulphide Toning.—J. H. Taylor, in an article on sepia tones on bromides, lays stress on the complete removal of the hypo from the prints, the slightest trace of which causes a sickly yellow tone. He finds that a hardening bath of formalin somewhat slows the bleaching process, while 1 in 20 alum bath does not. It is advisable to use the alum bath in warm weather.

As a darkening bath he prefers the following to the plain solution of sulphide :—

Pure sodium sulphide	2½ grs.
Hydrochloric acid	1 minim
Water	2 ozs.

The following bleaching bath due to Sedlaczek, gives a good greyish-sepia with a slight tinge of purple, which is a near approach to the true water-colour sepia :—

Potass. ferricyanide	24 grs.
Potass. oxalate	24 grs.
Water	1 oz.

—“A.P.,” Nov. 5, 1907, p. 445.

Factors in Sulphide Toning.—H. W. Bennett draws the following conclusions from experiments made on the sulphide toning of bromides. A strong developer tends to produce cold tones; a weak solution gives weaker or very warm tones, brown tones with tendency to yellow-brown. Bromide in the developer tends to warmth

of colour, but to a notable extent only if largely used. A weak developer dosed with bromide gives disagreeable warm tones and weak prints. Full or partial development of prints which have received identical exposures does not affect the colour of the tone. A print reduced with Farmer's reducer is not thereby affected as regards its colour in the sulphide process. A very suitable developer for prints to be sulphide-toned is :—

Diamidophenol	6 grs.
Sodium sulphite	36 grs.
Potassium bromide	1½ grs.
Water	4 ozs.

which is very similar to amidol and dianol.—“A.P.,” Jan. 7, 1908, p. 7.

H. W. Bennett gives directions for obtaining a range of tones by using a bleaching solution of (1) ferricyanide and bromide, and (2) mercuric chloride and potass. bromide, in conjunction with a darkening solution of (a) sulphide and (b) Schlippe's salt. The formulæ for these solutions are as follows :—

I. Potass. ferricyanide	4 grs.
Potass. bromide	6 grs.
Water	1 oz.
II. Mercuric chloride	120 grs.
Potass. bromide	120 grs.
Water	10 ozs.
(a) Sodium sulphide	4 grs.
Water	1 oz.
(b) Schlippe's salt	4 grs.
Water	1 oz.

In all the above instances it is preferable to prepare these working solutions from stronger stock solutions.

TABLE.

Colour.	Bleaching Solution.	Darkening Solution.
Pure black	{ No. 1 solution, 1 part	Solution a
	{ No. 2 solution, 1 part	
Brown-black	{ No. 1 solution, 2 parts	Solution a
	{ No. 2 solution, 1 part	
Deep brown	{ No. 1 solution, 3 parts	Solution a
	{ No. 2 solution, 1 part	
Dark brown	{ No. 1 solution, 5-7 parts	Solution a
	{ No. 2 solution, 1 part	
Rich warm brown	No. 1 solution	Solution a
Red chalk	No. 1 solution	Solution b
Red brown	No. 1 solution	{ Solution a, 1 part
		{ Solution b, 7 parts
Very warm brown	No. 1 solution	{ Solution a, 1 part
		{ Solution b, 4 parts
Warm brown	No. 1 solution	{ Solution a, 1 part
		{ Solution b, 2 parts

When using the mercury solution in a bleaching bath, the bleached prints, after the usual washing in several changes, should be given two or three washes in very weak hydrochloric acid, 1 dr. of acid

to 10 ozs. of water. They are again washed in three or four changes of clear water before sulphiding. The mercury has a strong intensifying action on the print, for which allowance must be made, but its effect when mixed with five to seven parts its volume of ferricyanide is insignificant. When using Schlippe's salt for darkening the image, it is very desirable that the prints should be freely exposed to daylight while in the darkening solution, or in the first washing water after darkening. By this means the brightest red colour is obtained.—"A.P.," Jan. 14, 1908, p. 30.

W. Morrison gives formulæ for three bleaching and three darkening solutions, by ringing changes on which a range of tones of different colour and intensity is obtained. Of the bleachers, No. 1 is potassium bichromate and hydrochloric acid, No. 2 is the mixture of ferricyanide and bromide, and No. 3 is the lead ferricyanide formula used for intensification. Of the darkening solutions, A contains rodinal, 20 to 30 drops; sodium sulphide (saturated solution), 30 drops in two ounces of water. B is a 1 per cent. solution of Schlippe's salts, containing also $\frac{1}{4}$ per cent. of liquid ammonia. C is a 1 per cent. sodium sulphide solution. Using No. 1 bleacher, A gives warm black on bromide paper, B a light reddish-brown, and C a dark brown.—"B.M.," Sept. 1908, p. 169; "B.J.," Sept. 11, 1908, p. 694.

Varying the Shade of Sepia in Sulphide Toning.—H. T. Munkman has examined the usual factors in the making of a sulphide toned print with a view to discover the control of colour possible. The bleaching solutions examined were:—

Potass. ferricyanide and ammonium bromide.

Potass. ferricyanide and potass. bromide.

Potass. ferricyanide and sodium chloride.

Potass. ferricyanide and ammonia.

Potass. bichromate, sulphuric acid, and sodium chloride.

Copper sulphate, sulphuric acid, and potassium bromide.

Identical shades of sepia were obtained with all these baths on finally sulphiding. With certain baths—notably, the ferricyanide and ammonia—there is some reduction, and an unpleasant yellow brown image is given in these cases.

No differences were noticed as a result of the developer used for the bromide, amidol, hydroquinone, metol-hydroquinone, rodinal, and glycin behaving similarly.

Exposure and development were found to affect the final tone. The less the exposure and the more forced the development the colder is the shade of sepia produced. A print so exposed to give a properly developed result in two or three minutes will certainly give a rich dark sepia.—"B.J.," Feb. 21, 1908, p. 139.

[As regards the bleachers, all those mentioned by Mr. Munkman may be described as simple bleachers; that is to say, they convert the silver into a silver salt without depositing any appreciable quantity of foreign compounds in the film. Others, such as bichromate with a very little hydrochloric acid, or ozobrome solution, leave a fairly substantial deposit in the film, and our experience

is that this deposit may appreciably affect the final colour. It is on account of this deposit that the colour obtained by using soda sulphide after bichromate and hydrochloric acid is generally less pleasing than that produced when ferricyanide and bromide forms the bleaching solution.—Ed. "B.J.A."]

Hypo in Sulphide Toning.—In reference to a suggestion that weak prints are caused by traces of hypo in the print, which, with the ferricyanide of the bleacher, forms a weak reducer, C. Welborne Piper finds that a negative one-half of which contained hypo gave a much lighter deposit on being treated by the sulphide toning process of ferricyanide-bromide bleacher and sulphide solution.—"B.J.," April 24, 1908, p. 319.

Pure and Commercial Soda Sulphide.—Attention is drawn to the difference in tones produced by pure and commercial sulphide, ordinary sulphide giving a pure sepia brown, whilst the pure gives a photo-brown (purplish) colour, more akin to the thiomolybdate tone. But a necessary caution is that sulphide labelled "pure" is very frequently only the commercial article. Commercial sulphide on keeping in 10 per cent. solution has a yellow colour, whereas the pure sulphide is nearly colourless. The really pure sulphide should be purchased from a manufacturer of chemicals for analytical work.—"B.J.," March 6, 1908, p. 174.

Reducing Sulphide-Toned Bromides—H. E. Smith, in a paper on the chemistry of reducing sulphide-toned prints, recommends as the best reducer a mixture of—

Cupric bromide	3 gms.
Sodium bromide	25 gms.
Water	100 c.c.s.

This bleaches a sulphided print almost as rapidly as the sepia bleacher does an ordinary print, and the above mixture should, therefore, be mixed with three times its bulk of water to modify its action.

For reducing the red chalk gold-toned sepia prints the best reagent is a mixture of cupric chloride, made by mixing equal parts of 5 per cent. copper chloride solution and 15 per cent. sodium chloride (salt) solution.—"B.J.," Feb. 21, 1908 p. 137.

THIOMOLYBDATE AND THIOSTANNATE TONES.

Thiomolybdate Toning.—Harry E. Smith, as the result of examining a large number of double thio salts, finds that the alkaline thiomolybdates provide an excellent substitute for sodium sulphide in sulphide toning, being comparatively free from odour and from tendency to give a yellowish-brown tone, particularly on gaslight prints. Also, the thiomolybdate does not soften (slightly reduce) the bromide print as does sodium sulphide. A suitable solution consists of 1 drachm of 1 per cent. solution of thiomolybdate of ammonia in 1 oz. of water, to which is added 5 minims of .880 ammonia. After toning, prints are rinsed and placed for about five minutes in 5 per cent. ammonia. This latter bath clears the whites

to an extent that a final wash of not more than twenty minutes only is necessary.—“Phot. Journ.,” Oct., 1907, p. 361; “B.J.,” Oct. 25, 1907, p. 808.

H. E. Smith finds that, contrary to chemical authorities, weak solution of ammonium thiomolybdate made alkaline with ammonia keeps extremely well. For example, a toning solution containing 1 part of 1 per cent. thiomolybdate solution in 8 parts of water, and made alkaline with ammonia, tones satisfactorily after keeping six weeks in full daylight in a loosely stoppered bottle. After keeping another seven weeks it had somewhat decomposed, but toned a bleached print to a good sepia in twenty minutes. The solution is almost odourless, in which respect it is more satisfactory to dilute a concentrated solution at the time of use than make up fresh of the solid, since the crystals, on being dissolved, give first an odour of ammonia and then of sulphuretted hydrogen.—“B.J.,” Feb. 14, 1908, p. 117.

The following are the instructions for thiomolybdate toning issued by the makers of a special thiomolybdate preparation (Messrs. H. Edmund and Co.):—

Care should be taken to tone for the full five minutes in the B solution, or the tone may be too dark a brown.

If, however, on drying the print is too dark, it may be modified by again immersing in the bleacher for five minutes, washing out the bleacher (about five minutes in this case), and again immersing in the B solution (five drops or minims to the ounce) for five minutes; after which wash twenty minutes as before.

A more simple method of producing warmer sepia tones if desired is to increase the amount of ammonia in the toning bath by adding from one to two drops of strong (880) ammonia to each ounce of toning solution diluted ready for use. By this method a considerable range of rich brown tones may be obtained at will, suitable for different subjects.

If after toning the whites do not clear readily from the light yellow stain, an immersion of from two to three minutes in dilute ammonia (3 per cent. strength) will be found to greatly hasten the elimination of any stain. Most varieties of bromide postcards and gaslight papers may well be treated with the ammonia clearing bath in this way, in order to shorten the final wash.—“B.J.,” April 10, 1908, p. 286.

Thiostannate Toning.—H. S. Wellcome, A. G. Bates, and F. C. Starnes propose the use of thiostannates of the alkali metals, such as sodium thiostannate, as a substitute for sodium sulphide in darkening bromide prints which have been bleached for sepia toning. The prints are treated with a solution, say, of 1 part of sodium thiostannate in 100 parts of water, and a thiostannate has the advantage of being stable and non-deliquescent, and largely free from odour. The process may be used for intensifying negatives.—Eng. Pat. No. 12,304, 1907.—“B.J.,” Jan. 17, 1908, p. 44.

Thiomolybdate and Thiostannate Toners.—C. Welborne Piper, as a result of examining these toners, introduced in February, 1908, finds that the thiostannate gives a tone of a very soft brown closely

approaching sepia and resembling that of commercial soda sulphide at its best.

The thiomolybdate gives a quite different colour, best described as a "photographic brown," and resembling the purplish tone of the best commercial hypo-alum toned prints. A print toned as directed by the makers of thiomolybdate for full five minutes resembles a warm gold-toned P.O.P. If treated for three and a-half minutes only, the tone is slightly colder, whilst longer toning twenty minutes gives a browner—that is, less red—tone.

On reducing the toned prints with Farmer's reducer, that toned with thioannate or sulphide is changed to a very unpleasant yellow brown, whilst the thiomolybdate gives a brown of a very good tone.

Owing to the effect of intensification before noted, the thiomolybdate prints will stand more reduction than the others, but the process must always be somewhat risky.

The most striking changes of colour are, however, produced by modifying the bleaching solution. The thiomolybdate brown is naturally a very strong one, therefore, the bleachers that fail with sulphide may prove of value with the new reagent. A very beautiful soft brown of great depth and transparency is produced if potassium bichromate is added to the bleaching bath, or if ozobrome solution is used in place of the ordinary bleacher. For a portrait, or similar subject, in which fine modelling and soft gradation must be preserved, this appears to be an ideal toning method, and to be strongly recommended. The tone is quite exceptional, and the brown is one of a kind not usually obtained by way of sulphide toning.

A bleaching bath of bichloride of mercury, which is quite useless for the soda sulphide or thioannate toners, as the resulting tones are black, gives with the thiomolybdate toner a very rich purplish red brown. In using this bleacher the mercury should be followed by a soaking in weak hydrochloric acid, and this again must be followed by very complete and thorough washing, otherwise the whites will be badly stained.

The thiomolybdate toner gives off hardly any sulphuretted hydrogen, and even when it has been in use for a long time the odour can barely be detected. After toning, the whites are generally slightly stained, but this stain washes out in from twenty to thirty minutes under the tap. When bichromate is used in the bleacher the print must also receive a good washing between bleaching and toning. The fine colour obtained after this bleacher is no doubt partly due to the presence of chromium and iron compounds in the image, and the softness of the result is probably due in part to the fact that in the presence of these compounds toning does not go so far as usual. The difference in contrast between results produced by this method and by the standard method is very striking. —"B.J.," Feb. 21, 1908, p. 136.

GOLD TONING OF SULPHIDE-TONED BROMIDES.

Red Tones on Sulphide-Toned Bromides.—R. E. Blake Smith finds that with sulphocyanide at 1 gr. per oz. a duller tone is produced than with 3 or 4 grs. per oz. On toning a sulphided print red with a bath of—

Ammonium sulphocyanide	10 grs.
Gold chloride	1 gr.
Water	10 ozs.

and, after immersing in weak sodium sulphite, the image is much darkened again, toned to a brownish-red, and the whites are stained. But if the print before being put into the sulphite is fixed in 20 per cent. hypo the sulphite has no effect, nor has it if the toning bath contains 30 grs. or more of ammonium sulphocyanide. In both cases a silver compound, probably silver sulphocyanide is removed from the print, and hence it is well to fix prints after the sulphocyanide bath, the tone being thereby brightened. The best bath for complete toning, *i.e.*, the one giving the brightest red is:—

I. Gold chloride	15 grs.
Water	7½ ozs.
II. Thiocarbamide	50 grs.
Water	7½ ozs.
III. Sulphuric acid, conc.	½ oz.
Water to	20 ozs.

In making up the last solution, the sulphuric acid should be added to about 15 ozs. of water, and then be made up to 20 ozs. with more water.

Practically any acid can be used, but sulphuric acid will be found the most convenient. To make up the toning bath we take:—

No. I.	½ oz.
No. II.	½ oz.
No. III.	½ oz.
Water to	5 ozs.

No. I. and No. II. can be reduced to ¼ oz. each. No. I. should never exceed No. II. in amount. As in the case of the sulphocyanide bath the light parts are, as a rule, toned to their final colour rather before the darker ones, and so this bath is not advised for partial toning. A solution of a soluble sulphide seems to have no effect on a print toned with this thiocarbamide solution. At least an ounce of the above bath should be allowed for every quarter-plate print. This would make the cost of toning a 12 by 10 print in this manner work out at about 3d.

It is found that the red-toned print is permanent (1) on exposure to light, (2) when treated with hypo, and (3) when exposed to the action of sodium sulphide, but the toning process is slow, from half an hour to three hours, and it is necessary either to rock the dish or weight the print at the bottom of the solution by means of two glass rods.—"Phot.," Jan. 28, 1903, p. 76.

G. H. Scheer points out the advantage in the sulphocyanide toning method (see "B.J.A.," 1907, p. 793, and 1908, p. 652) of being able to stop the action at any point. The lightest tones are affected first,

so that for certain subjects good use may be made of the double toning action. A hypo-alum toned print is equally suitable for the process.

The toning bath of sulphocyanide 10 grs., gold 1 gr., in 10 ozs. of distilled water, requires from half an hour to an hour, and needs to be replenished with gold as it becomes exhausted. Prints which have had a brief exposure and long development, and which have been sulphide-toned to a deep dark brown, assume a pure red tone. With "Royal" paper the red is brick or chalk-red, whilst in platino-bromide it is more of a crimson. Long exposure gives yellowish-reds; short exposure brick-red and crimson.—"Photo Era," Mar., 1908, p. 138; "B.J.," Mar. 13, 1908, p. 194.

Gold Toning of Thiomolybdate-toned Bromides.—Harry E. Smith finds, in regard to the "red-chalk" toning of sulphided sepia bromides with a sulphocyanide gold toning bath, that this bath is not satisfactory with thiomolybdate sepia, the tones being, as a rule, a greenish brown. If the smell of ammonia is objected to in the thiomolybdate toning solution, one or two drops of a saturated solution of potassium metabisulphite may be used instead of the ammonia to each ounce of toning solution made up. This keeps the solution quite odourless, but the tone at first is nearly a black or blue-black, though it afterwards turns to a satisfactory brown. Toning solutions with metabisulphite, however, do not keep so well, the action of the metabisulphite being to break up the thiomolybdate. This process is very suitable for intensifying negatives, the intensification, owing to the colour of the deposit, as well as to the added molybdenum sulphide, being very considerable.—"B.J.," Oct. 25, 1907, p. 809.

Reducing Gold-toned Sepia Bromides.—See "Reducing Sulphide-toned Bromides" above.

SELF-DEVELOPING PAPERS.

Self-Developing Papers.—W. F. C. Kelly has patented the application of a developing mixture to the back or unsensitised surface of bromide, gaslight, or printing-out paper. A formula suitable for development papers is:—

Metal	2 grs.
Hydroquinone	5 grs.
Potass. metabisulphite (or soluble acid sulphite)	$\frac{1}{2}$ —1 gr.
Potass. bromide	$\frac{1}{8}$ gr.
Borax	10—20 grs.
Gum, or other suitable colloid	$\frac{1}{4}$ gr.
Water	Sufficient to make a thin paste.

The above is suitable for from a quarter-plate to a half-plate size.

The materials having been ground together and well mixed, may be applied to the back of the sensitised paper, which is then allowed to dry.

When the dry developing composition is used in conjunction with a printing-out paper which has only received a fraction of the correct exposure, and it is wished to complete the photographic

effect by development, the borax of the above formula may be replaced wholly or in part by boracic acid and the proportion of acid sulphate increased, or the preparation rendered acid by other means.

Under certain atmospheric conditions, it may be well to employ as a protective medium for the developer a coating or wash of gum arabic or saccharine substance, such as ordinary sugar, in solution, or a mixture of both. The saccharine substance may, however, be used in conjunction with the gum, or other suitable colloid, in compounding the mixture. A further advantage resulting from the use of sugar is that protection is afforded against oxidation, and it also has a hardening and stiffening effect.—Eng. Pat., No. 13,835, 1907.—“B.J.,” July 10, 1908, p. 534.

Carbon Prints from Bromides.—The working instructions for the “carbograph” process of using a bromide paper, the emulsion of which is incorporated with a pigment, are given in “B.J.,” November 15, 1907, p. 860.

For further notes on the process by C. Welborne Piper, see “B.M.,” January, 1908, p. 4, and March, 1908, p. 49.

The Carbon Process.

Carbon Prints on Japanese Vellum.—A hitherto unpublished method of transferring carbon prints on to hand-made Japanese vellum paper without injuring the peculiar sheen of that material is as follows:—The tissue is mounted on a flexible support and developed as usual, except that it is not alumed. The best temporary support is good quality paper coated with india-rubber solution, which can be easily made by the worker by simply drawing the paper through rubber solution thinned down to the consistence of thick cream with benzole. This is done a day or two before use, so as to allow the benzole to evaporate completely. When dry the face of the picture is coated with a solution of soft gelatine, say 2 ozs. of Cox's soup gelatine or Nelson's No. 2 soluble dissolved in a pint of water. This is applied with a camel-hair brush, and when it is dry the print is trimmed to size and is ready for its final transference to the Japanese paper. The gelatine surface is evenly moistened with a sponge which is damp only, and the Japanese paper, having been marked where the picture is to go, is laid on the bed of a rolling press, the print laid face downward upon it, and the two passed slowly two or three times between the warm rollers, when they will firmly adhere. After an hour or two for the gelatine to dry thoroughly the temporary support is removed, after going over it with a sponge moistened with clean benzole. Two or three minutes after this operation the support can be lifted off, and any rubber which chanced to be left on the surface of the print can be rolled off with the ball of the finger.—“B.J.,” Jan. 17, 1908, p. 41.

Carbon Prints on Watch Cases, etc.—Instructions are given for transferring carbon prints to articles of jewellery, etc., in “B.J.,” Feb. 7, 1908, p. 98.

In a later article, "B.J.," Feb. 21, 1908, the necessary directions for making carbon prints on ivory are given.

Cerium-casein Carbon Process—J. T. Gateau has patented a method of pigment printing in which a cerium, uranium, or ferric salt is mixed with an acid or alkaline albuminate. These albuminates and albumens are insoluble in pure water, but are soluble without any alteration by means of neutral salts, alkalis, or acids, and can again be precipitated from these solutions.

When these derivatives of albumens are exposed to the light after they have been mixed with a ferric salt, which, when exposed to the light, forms an insoluble oxide, they become less easily soluble in their ordinary solvents. In this manner emulsions can be produced by means of ferric salts, cerium salts, and uranium salts, the sensitiveness of which is nearly equal to the sensitiveness of chromic salt emulsions.

To produce the colloidal substance, the albuminates are dissolved in water, to which previously a solvent (ammonia, borax, carbonate of soda, etc.) has been added; hereupon the ferric salt is added, and, further, the pigment and emulsion are spread on a glass slab or paper.

After the paper has been exposed, the photograph is developed in a bath capable of dissolving the albuminous substance (ammonia, carbonate of soda, oxalate of potassium).

A formula is:—Casein (anhydrous) (5 gms.) is dissolved in water (75 c.c.s.) containing ammonia (2 c.c.s.). Ferric ammonium citrate (2½ gms.) is added, pigment is admixed, and the mixture spread on paper.—Eng. Pat., No. 20,740, 1907; "B.J.," July 17, 1908, p. 551.

The Ozobrome Process.

Improved Ozobrome.—From May, 1908, a modification in the pigmenting solution issued by the Ozobrome Company has been made, and possesses the advantage of giving (by slight modification of the procedure) very great uniformity in the Ozobrome copies prepared in one batch of diluted pigmenting bath. Instead of soaking the pigment tissue in water as previously, weak hydrochloric acid (1 drachm in 25 ozs. of water) is used, the other procedure being the same. The contrast of the Ozobrome print can be modified by altering the time of immersion of the tissue in the weak acid; the longer the immersion of the tissue the softer the Ozobrome print. The following table has been drawn up by Mr. Manly as a guide to the process:—

	Immersion of plaster.	
	Seconds in acid bath.	Seconds in pigmenting bath.
For a normal bromide print with a good range of tone	30	... 90
For a bromide print that is weak and grey	10 to 20	... 90
For a bromide print that has strong black shadows and harsh contrasts...	40 to 60	... 90

—"B.J.," May 22, 1908, p. 392.

Fogged and Flat Ozobrome Prints.—H. W. Dick finds that fog in Ozobrome prints is due to too much alum in the sensitising solution as well as, of course, to degraded bromide prints. He concludes that while a little alum added to the normal bath will serve to give a softer result from a hard bromide print, any excess of alum will produce flatness and fog. That citric acid in small quantities will greatly lift the shadows without proportionately lifting the high lights. In other words, it gives flatness. That ammonia in small quantities will restore a bath that is working flatly through acid. (Ammonia will do the same for a bath working flatly through excess of alum.) Excess of ammonia will produce harsh prints even from flat bromides. A degraded bromide print will probably reproduce its degradation with interest. Alum left in the film of the bromide will give flatness in the Ozobrome—"A P," Jan. 21, 1908, p. 65.

Ozobromes from Toned P.O.P. Prints.—W. Findlay finds that to make an Ozobrome print from a toned print on gelatine or collodion P.O.P., the latter should be immersed in a solution of potassium bromide. Three minutes in a 10 per cent. solution was found sufficient treatment. The prints were then drawn through water once and laid face upwards on a piece of cotton cloth. They were then brought in contact with the Ozobrome pigment tissue in the ordinary way and Ozobrome copies successfully obtained, except that an increase of contrast was noted and some detail was lost. On re-development of the P.O.P. prints with amidol it was found that they came up very slowly, and had the lemon-yellow appearance of a fixed but untuned print. It was found, however, that after again treating them with potass. bromide solution a further Ozobrome copy could be obtained.—"Photo-Era," May, 1908, p. 224.

Control in Ozobrome.—A. H. Blake, in using Ozobrome for pictorial work, prefers the method of super-posing the Ozobrome print on the bromide. For one reason adherence of the pigment print is better for subsequent work with a pencil or brush. When an Ozobrome by this No. 1 process is to be controlled, the extra alum solution for retaining lighter details must not be omitted nor sight lost of the fact that its action does not last long; if, more than, say, two hours intervenes between the "pigmenting" of the print the alum solution must be renewed.

The first opportunity for control in Ozobrome is when developing the pigment print on the bromide support, when much can be done by using a soft brush on the print held just under the surface of the water. The print should not be removed repeatedly from the water; otherwise it is apt to become reticulated.

After development and immersion in cold water for a minute or two the print can be spread on a sheet of glass, and is then amenable to further control.

Lastly, when nearly dry still more control with a brush or with the ball of the forefinger can be done.—"Phot.," Dec. 31, 1907, p. 536.

Dr. O. Boerner, in a specification relating to producing pictures in pigment from silver images, which appears to be based on that of the Ozobrome process, puts forward the use of catalytic agents, such as salts of cerium, etc., for hastening the reaction between the silver image and the mixture of bichromate and ferricyanide with which it is treated whilst in contact with the carbon tissue. The object of the catalyser is to hasten the second phase of the process, namely, the oxidation of the ferrocyanide into ferricyanide. A suitable formula when working from a P.O.P. print is :—

Potass. ferricyanide	2 gms.
Potass. bichromate	3 gms.
Potass. bromide	1 gm.
Cerium sesquisulphate	0.17 gm.
Water	100 c.c.s.

The quantity of the sesquisulphate of cerium can be increased two-fold; further, 0.1 gm. alum and 0.05 gm. citrate of potassium can be added to such a solution as the above. Also iron-alum or other iron salts can be employed together with cerium salts by adding about 0.085 sesquisulphate of cerium, 0.047 gm. ammonia-iron alum, and 0.05 gm. citric acid to the above solution. For employing two catalysers simultaneously it is preferable in many cases to use a weaker bath, such as is given for originals on developing paper, and to add to it in addition about 0.29 gm. sesquisulphate of cerium and 0.05 gm. citrate of potassium per 100 c.c.s.—Eng. Pat., No. 19,889, 1907; "B.J.," Jan. 17, 1908, p. 44.

Ozobrome for Intensifying Negatives.—See "Negative Processes—Intensification."

Gum-Bichromate.

Gum-Albumen Formula.—E. Fancourt recommends the addition of albumen to the gum-sensitising solution, as the whites of the picture are more easily kept clean. The formula is :—

Bichromate (solution A)	1 oz.
Gum arabic, finely powdered	$\frac{1}{2}$ oz.
Albumen, white of egg, beaten up	2 drs.
Glycerine	$\frac{1}{2}$ dr.
Pigment	as necessary.

The solution A is made by adding ammonia to a cold saturated solution of potass. bichromate until the mixture turns red litmus paper faintly blue.

In preparing the sensitive mixture the solution A is warmed, the powdered gum and glycerine added in small doses, then the albumen, and finally the pigment, which is mixed with a spoon or spatula. The mixture should be about as thick as honey, and should be coated thin enough to allow the lettering on a piece of printed paper to show through. The coated paper should appear glossy when dry. If it is matt, there is too little gum. Too much albumen lowers the sensitiveness.—"Bull. Phot.," April 15, 1908, p. 312.

MULTIPLE GUM

Supporting the Print in Multiple-Printing.—Nelson K. Cherrill has published particulars of a method of supporting the print in multi-gum work in such a way that it will adhere firmly during the series of developments, but is instantly removed at the last. It is a modification of the shellac mounting method devised by him. (See under "Mountants.") Paper will adhere firmly to a greased zinc plate if mounted thereon with shellac solution. If the operation is properly carried out the paper may be repeatedly wetted and dried without showing a trace of blistering or other detachment from the zinc. Hot water may be used with equal impunity, and with no greater risk than with cold; while the curious and interesting part of the matter is that when *quite* dry the paper can be removed from the zinc with the utmost ease by simply inserting a knife-blade under one edge, when it will come off with a snap, bringing with it a quite smooth coating of shellac. It will then be ready for permanent mounting in the manner already described.

Rolled zinc is used as the support. If thick, it should be perfectly flat for proper contact. A thin plate is just as effective, and permits of good contact being obtained, even if it is not perfectly flat. The zinc is first rubbed well over with coarse glass-paper, to scratch the entire surface. A few drops of ordinary machine oil are then poured on the surface and rubbed over with flannel, the surface being then well polished with a larger pad of flannel. At first this pad will come away very black and dirty, from the particles of the zinc scratched up by the glass-paper; but after a second or third application, using a fresh part of the flannel each time, the pad will be only very slightly marked, and the zinc plate will be ready for use.

The shellac solution is best brown shellac, 10 parts, mixed with 15 parts of methylated spirit of good quality, such as that marked "O" by Griffins, at any rate fully 95 per cent. The mixture is filtered through muslin when the shellac has dissolved, and a coating of it is applied all over the back of the paper, which is then dried. The sheet of paper to be printed on should be considerably smaller than the zinc plate and somewhat larger than the negative. When commencing work a second coating of shellac is given to it, and when half-dry the paper is lowered very slowly from one corner on to the zinc, sweeping it from side to side as it is lowered to avoid the imprisonment of air-bells. A sheet of clean blotting-paper is now laid on, and firm pressure applied with the roller squeegee. After this it is well to give the plate ten or fifteen minutes in a screw press, when it is ready for receiving the sensitive gum preparation. It may be developed, re-coated, and re-developed as many times as desired. When finished it is made bone dry by prolonged gentle heat, and detached from the plate by inserting a pen-knife under one end. Should it chance to stick, as may be the case when using new zinc, the plate should be held for a few moments over a gas-burner, when the shellac will be softened and the picture come away.

Any tendency on the part of the print to leave the support prematurely can be corrected by a touch of a mixture of acetone 9 parts, alcohol 1 part, introduced under the paper on a feather. The plate is then again pressed and the adhesion made perfect.

The knack to be acquired in working this process consists in hitting off exactly the right amount of grease to be left on the plate. If there is too much the paper leaves the plate too easily; if too little it sticks too tightly, and needs heat to secure its removal. After one or two trials it is easy to judge of the degree of greasiness by the colour of the flannel with which the plate is finally wiped. It should, at the last rub, be only just slightly dirtied by the particles of zinc coming off the plate.—“Phot. Monthly,” April, 1908, p. 107.

The Oil Process.

The Rawlins Oil Process.—The report of a practical demonstration given by John H. Gear at the Royal Photographic Society contains a detailed description of the technique of the process.—“Phot. Journ.,” March 1908, p. 129; reprinted in “Phot.,” April 7, 1908, p. 296.

Preparing Paper for Oil-Printing.—Malcolm Arbuthnot prefers to prepare his own paper for the oil process, using a good grade cartridge paper, a hot press Turkey Mill, Michellet's, O.W., or Whatman's hot-pressed, the two latter having rather more grain, and being, therefore, not so easy to coat and afterwards pigment. The aim should be to get a paper soft enough to absorb the gelatine to some extent, thus obtaining a good hold, and, at the same time, to form a thick film on the surface. In short, the gelatine coating must be adjusted to the quality of the paper. The ordinary cooking gelatine of Nelson's is found suitable—at any rate, for work in the winter. In adjusting the thickness of coating it is best to work always at the same temperature, and to use the same amount of solution for a given size of sheet, the variation of thickness being obtained only by varying the strength of the gelatine solution. For a normal coating 30 grs. of gelatine are used per oz. of water, and $2\frac{1}{2}$ ozs. of this solution used for a sheet 16 by 13 ins. at a temperature of 76 F. The gelatine may be increased to 50 or 60 grs. per oz., but the thicker coating gives an objectionable glossy print.

The paper is placed on a piece of plate glass, placed on a larger piece of levelled board or glass. The paper is first immersed in hot water, and the coating glasses likewise put to warm in hot water. The warm coating solution is poured over the paper while the latter is supported on its glass, this latter again being held in the hand just as when varnishing a negative. As soon as the paper is covered it is laid down, still on its glass, on the levelled support. Any air-bells are removed, say, with a warm teaspoon. As soon as the gelatine begins to set it must not be touched for five or ten minutes, after which it will have become partially set, can be removed to another fairly level support (of ordinary glass), and the coating of the next sheet proceeded with. When

quite set, after about two hours, it is pinned up to dry, which it does in from twenty-four to forty-eight hours.—“P.N.,” March 20, 1908, p. 271.

Sensitising Oil Tissue.—G. E. H. Rawlins recommends that the tissue be sensitised in a quite flat-bottomed dish, a couple of sizes larger than the paper, and that after immersion for two or three minutes the solution be poured off and the dish held in a sloping position. The paper is then drawn slowly off by an upper corner, and this action, if repeated two or three times once for the back and twice for the face of the sheet, removes all excess of sensitiser and obviates the formation of drops on the surface.—“A.P.,” Nov. 5, 1907, p. 432.

Spirit Sensitisers for Oil Printing.—S. L. Coulthurst recommends the Autotype spirit sensitiser, applied according to the makers' directions with a Blanchard brush, for sensitising tissue for the Rawlins process. In place of the glass as a support for the swansdown of the Blanchard brush a piece of thick celluloid may be used, thus giving a certain amount of spring to the brush.—“A.P.,” May 5, 1908, p. 448.

Cold Weather and Oil Printing.—Want of contrast in bromoil prints is easily caused by low temperature not only at the time of pigmenting but of the solutions used in preparing the print. If these are too cold the gelatine in the non-image does not swell sufficiently or become absorbent enough to hold the water required to repel the pigment. Solutions should be used at least 65 deg. and washing done by hand, as it can be quite efficiently. The pigmenting pad should also be soaked in warm water before use.—“B.J.,” Dec. 20, 1907, p. 954.

Temperature in Pigmenting.—About the best remedy for the rapid drying of the print during pigmenting, and the resulting trouble due to the pigment taking in the wrong places and giving a flat print, is to adopt an extra thick and very wet pad of blotting-paper for the support, and to select thick paper for pigmenting upon. If using the bromoil process a thick card bromide paper can be used, and this holds the moisture excellently. The greater part of the trouble is, however, due to the fact that the moisture quickly runs out of the blotting-paper pad at the edges, being forced out more or less by the dabbing action employed in pigmenting. The best remedy would probably be the use of a very shallow tray in place of the usual sheet of glass.—“B.J.,” Nov. 22, 1907, p. 878.

Dr. A. R. F. Evershed finds that to prevent the print drying too quickly whilst pigmenting, it is a good plan to first lay on the plate glass basis two layers of old clean linen, then over this two pieces of white blotting-paper. The blotting-paper should not be used more than three times, as frequent wettings have the effect of causing it to be less porous; doubtless also the “dabbing” has some result on this loss of porosity. The tendency of the pigment to become too thin can be obviated by allowing some of the excipient to evaporate, after it is spread on the palette, and before charging the brush.—“B.J.,” Nov. 29, 1907, p. 915.

Ozobrome-oil Process.—J. Parrack describes the following process, by which any number of oil prints are obtained from a single bromide or gaslight print. The bromide print is prepared as for Ozobrome, and a piece of oil-pigment paper (as for the Rawlins process) is dipped in the Ozobrome bichromate bath and squeegeed in contact just as in the Ozobrome process. The two are separated, and the oil-tissue pigmented as usual.—“A.P.,” May 12, 1908, p. 483.

The Bromoil Process.

(Oil Prints from Bromides.)

Bromoil Bleaching Formula.—M. E. Coustet recommends the following bleaching solution for the conversion of a bromide print into a state which will allow of the image being pigmented (compare with the Welborne Piper formula in which Ozobrome solution is used):—

Lead nitrate	5 gms.	150 grs.
Potass. ferrieyanide	5 gms.	150 grs.
Water	100 c.c.s.	7 ozs.

After ten minutes, the image appears as reddish on a yellow ground, and the print is then well washed in several changes. At the end of an hour the image will be scarcely visible, and pigmenting can then be done. If the print remains longer in the water the image returns a little, in consequence, no doubt, of the oxidation of the lead salt in light. M. Coustet recommends fixing the pigmented print in hypo in order to avoid after-darkening of the print, but M. du Maréchal finds that exposure for a whole day to sunlight does not cause any darkening of the print.—“Photo-Revue,” August 2, 1908, p. 38.

Bromoil Pigment.—T. H. Greenall finds that the addition of colour to the mixture of Japan gold size and raw linseed oil used by him for glazing bromides by the bromoil process (see under “Bromides”) gives a pigment suitable for this latter process. Any powder colour may be used, but it must be fine. Paint-shop colours are too gritty except for large work. The smoke from a small lamp burning turpentine, if caught on the palette, or, better, on a 12 by 10 enamelled iron developing tray, will give a very pleasing black. The powder is made into a stiff paste with the least possible quantity of Japan gold size, and is then placed in a small covered tin. For use a little about half the size of a pea (for a 10 by 8 print) is spread out on the palette, with one drop of a mixture of one part raw linseed oil and two parts common benzoline. The benzoline quickly evaporates when the paste is spread out, and is only used to dilute the oil. If the paste was originally stiff, it may mean another drop of the medium before it will touch even the shadows, but it is best to keep on the hard side and soften very cautiously. At a certain moment you will get a pigment which will give all the tones and leave the whites clear, which is what you require. Should extra brilliancy or more vigour be necessary, add one drop of the gold size and less of the oil, but the brush should remain clean, and if you make a mistake, simply wipe off the

picture with a rag moistened with benzoline, wash the print with soap and water, and start afresh. This may be done even after the print is dry. A little time and practice are required in order to acquire the "touch" in pigmenting, but as one bromide will serve as long as the paper will hold together, the expense of waste material is negligible.—"A.P.," Jan. 28, 1908, p. 84.

Pigmenting Bromoils.—F. C. Tilney finds it best to ink with the oblique brush (*pied de biche*) and spread with a straight. The use of the hopping attachment for a brush gives the effect of a thinned-down pigment—namely, smoothness of tone—and is better for obtaining the utmost definition, contrast, and force, whilst it saves muscular effort. An inked finger used on the wet gelatine is an excellent tool for drawing clouds. Mr. Tilney affirms it practicable to make considerable modifications in the subject when using bromoil, such as removing the upper part of a large gable and turning the bottom part into a tree.—"B.J.," March 6, 1908, p. 175.

Toughening the Bromoil Surface.—T. H. Greenall finds that the gelatine film of a bromide treated for the bromoil process may be made much more highly resistant to the pigmenting brushes if the paper be treated before making the print with a solution of formaline in alcohol. Formaline (50 minims) is dissolved in ordinary methylated spirit (5 ozs.), and the paper is immersed for half a minute and pinned up to dry. It appears necessary to employ the formaline on the sensitive bromide paper, its action not proving successful at later stages. Bromides for bromoil thus treated are able to withstand almost any amount of friction under the brushes.—"A.P.," September 8, 1908, p. 232.

Bolting Silk for Bromoil Bromides.—T. H. Greenall recommends placing a screen of bolting silk between negative and condenser (about $\frac{1}{4}$ in. behind the negative) when making enlargements for the bromoil process. The advantage of thus breaking up the image into regular minute dots is specially felt where there are large areas of shadow.—"A.P.," September 8, 1908, p. 232.

Silver Images and Bichromate.—In an article on the need for research on the action of silver and other images on bichromate, attention is called to some of the obscure points in such processes as ozobrome, bromoil, etc. The final bromoil image contains cyanogen compounds, which is not the case with an image bleached with ferricyanide and bromide alone. The fact that it is the case when bichromate is present points to some difference in the reaction. Also the large excess of alum essential to the bromoil process suggests that possibly the gelatine is precipitated and hardened by ferrocyanic acid.—"B.J.," Feb. 14, 1908, p. 115.

Platinum Printing.

Platinum Residues.—Pirie Macdonald, in commenting on the good return to be obtained from platinum residues, recommends the following method of recovering the precious metal:—

The real way to do it is to take a twenty-gallon stone jar, pour

into it the first acid wash both from sepia and black, and if you have any developer to throw away, pour it in too.

Then cut two sticks and make a cross of them—large enough so that they will bridge the top of the jar, and won't fall in, and suspend from the cross by a stout string some strips of zinc (sheet zinc at a hardware store costs 30 cents per pound, but you can buy scrap zinc from photo-engravers, the odds and ends cut from their plates, at 5 cents per pound). Let the zinc hang down to within, say, three inches from the bottom of the jar, but don't let it touch the sludge, for it will become coated and inactive.

When the solution has stood twelve hours it will settle and should become colourless, but if it remains to any degree yellow, it still has platinum in suspension, and you must add, say, one-half ounce of muriatic acid. Scrape the zinc free from any coating it may have accumulated, and examine the solution again after another twelve hours. This, however, will rarely be necessary.

When the liquid has become colourless, dip out most of it, and let it go down the sink, being careful not to disturb the whitish-grey sludge that has been thrown down on the bottom of the jar, and when you have used 100 rolls, take out the mud, drain it on a cloth, which you have tacked on a stretcher, letting the drip go back into the jar, and when dry it is ready for the refiner.—From "Photographer," "B.J.," Nov. 29, 1907, p. 899.

Iron Printing Processes.

(Other than Platinum.)

Kallitype.—James Thomson corrects the formula given for the development of Kallitype paper in "B.J.A.," 1908, page 665. The corrected formula for the stock solution is as follows:—

Distilled water	1 oz.
Silver nitrate	40 grs.
Citric acid	10 grs.
Oxalic acid	8 grs.
Phosphate of soda	1½ grs.

When thoroughly dissolved, decant, or filter through a piece of fine linen.

To develop, take one (1) drachm of stock solution to every seven (7) drachms of water.—"B.J.," Jan. 31, 1908, p. 93.

Sepia Paper.—A. J. Jarman recommends for the after treatment of paper sensitised with a ferric salt and silver nitrate (according to a formula such as that given under "Iron Printing Processes" in the Formulæ section of the "Almanac") the following process:—The print on removal from the frame is given half a dozen changes in clean water, and is then bleached in—

Potass. bromide	120 grs.
Mercury bichloride	120 grs.
Water	30 ozs.

Hot water is used in making the solution, which is, however, employed cold. The bleached print is again well washed, and the image brought back in a hypo solution containing 3 ozs. in 20 ozs.

of water, which gives a bright brown print. A second bleaching, washing and immersion in hypo is advised for sepia prints.—“Photo. Era,” March, 1908, p. 133.

Gum-ferric Positive Process.—H. L. Shawcross has further patented a development of the process described in “B.J.A.,” 1908, p. 667. Solution of potassium ferrocyanide is used for producing on the surface of a gum-ferric film exposed to light an image which is a negative of the original. Before exposure the gum film is permeable by the ferrocyanide solution, and becomes impermeable in proportion to the action of the light. On treatment with the solution the unexposed parts absorb the latter, and, in this case, repel printer's ink, the ink attaching itself to the exposed or non-absorbent parts, and allowing copies to be taken off in a press.

In making one single copy the exposed paper or film is first inked up all over, then immersed in the ferrocyanide solution, and transferred to a water-bath. The excess of ink is removed by gentle rubbing, and there is then obtained a negative copy (on a blue ground) of the original. The penetration of ink into the film and the spotting or speckling thereby produced is obviated by addition of alcohol to the solution of gum, etc., used to form the sensitive film. The proportion of alcohol varies; in some cases 20 per cent. may be used.—Eng. Pat., No. 19,534, 1907; “B.J.,” Oct. 2, 1908, p. 759.

Miscellaneous Printing Processes and Prints on Various Supports.

Molybdic Emulsion Paper.—J. de Ruiter has patented a method of preparing sensitive paper by treating substances, such as gelatine, albumen, or gum, with a solution of molybdic, tungstic, or uranic acid, so that the mixture contains free acid. If alkaline salts of the above acids are used, the mixture must be made acid, say, with hydrochloric, as the sensitiveness to light depends on the presence of excess of acid. Paper coated with this mixture gives a positive print under a negative, a coloured oxide, insoluble in water, being formed in the exposed parts. Molybdic acid is the most suitable substance; papers prepared with tungstic acid require to be fixed soon after exposure.

Fresh albumenised or gelatinised paper is first saturated with gelatino-chloride in solution (produced by heating gelatine with dilute hydrochloric acid). The paper, having been drained, is floated upon a concentrated solution of molybdic, tungstic, or uranic acid. For gelatine papers the treatment with molybdic, tungstic, or uranic acid alone will suffice, provided the gelatine is first permitted to swell in water. If, however, compounds of molybdic, tungstic, or uranic acid having a neutral or alkaline reaction are used, then sufficient acid—hydrochloric, for instance—must be added to cause an excess of free acid. The manufacture may also be done by floating albumenised paper, firstly on a solution of gelatino-chloride and then upon a solution of metallic acid.

The prints are treated with a solution of barium or aluminium acetate, which will not affect the exposed parts, but will transform the unexposed parts into substances not soluble in water and not sensitive to light. The unexposed parts remain white, and therefore have no disturbing effect upon the image. The prints are then washed to take away any excess of barium or aluminium acetate. If, say, molybdenum paper is used, permanent prints in a blue tone from any suitable negative may be obtained. The pictures so produced may, if desired, be toned with gold or platinum.—Eng. Pat., No. 13,736, 1907; "B.J.," Feb. 28, 1908, p. 164.

Uranium Printing.—Dr. John Bartlett has found that a sheet of paper rendered sensitive with oxalate of uranium (probably the formula in "B.J.A.," 1908, p. 669, Ed.), and exposed for some time in contact, in the dark, with an engraving, became impressed with a distinct image of the print. The paper had been coated in a very feeble light, and therefore could have absorbed but very faint radiations.—"Journ., Franklin Institute," Dec., 1906, p. 473.

Silver-Chromate Prints.—A. J. Jarman recommends the following extraordinary toning bath, which, he alleges, on no apparent grounds, to give prints consisting of silver chromate. The bath is—

Hyposulphite of soda	1 oz.
Water	16 ozs.
Potass. bichromate, saturated solution	$\frac{1}{2}$ oz.
Citric acid solution 60 grs. per oz.	1 or 2 drs.

Prints are made upon collodion paper, carrying printing to the bronzing point. It is directed to wash them, and then tone for a short time in the above mixture which lightens the print greatly and changes the colour to a brick-red.—"Cam.," Oct. 1907, p. 367.

(We usually ignore in this section of the "Almanac" recommendations—and there are many of them—which are palpably impracticable or unsound, but the fact of the above suggestion emanating from a writer whose so-called researches appear in almost every American photographic paper renders it advisable to point out that Mr. Jarman's toning mixture is nothing more or less than a sulphur toning bath produced by the action of the potassium bichromate upon hyposulphite of soda. In suggesting that the prints consist of silver chromate, Mr. Jarman put forward not a single fact in substantiation. In short, his process is a rapid and effective means of spoiling good collodion paper.—Ed. "B.J.A.")

Photo-Etchings on Glass.—J. H. and E. Frey have patented a method of transferring designs to glass or stone for subsequent etching by a sand-blast. The glass is coated with a mixture of bichromated gelatine containing sugar and glycerine, which is applied thickly, and, if necessary, rendered even by a wiper, consisting of a thin steel blade, which can be drawn over the plate at an adjustable distance from it. Development is done in hot water, and the picture when dry further treated in a solution of gum and glycerine, after which it is dried, and is ready for treatment by the sand-blast.—Eng. Pat., No. 2,291, 1907; "B.J.," Dec. 6, 1907, p. 924.

THE DONISTHORPE PROCESS.

Prints in Dye from Negatives by Contact Without Light.—F. W. Donisthorpe has patented the following method of treating a negative and taking from it by contact on gelatine paper prints which reproduce in dye the tones of the negative.

After development and fixing in the usual way, the negative is immersed in a bath which renders that part which has been affected by the light in the camera unsaturatable by dyes and saturatable proportionately according to the amount of light that has fallen upon the different parts.

This bath may consist of various solutions, many chemicals having the effect in different degrees. The following are some which have the effect in varying degrees:—

(A) Uranium nitrate, 100 grs.; potassium ferricyanide, 100 grs.; water, 10 ozs. (B) A 2 per cent. solution of ferric chloride with a few drops of glycerine. Immerse in A for ten minutes and follow with B for the same period

Another bath is:—Stock solution A, $\frac{1}{2}$ oz.; stock solution D of Leto toning for bromides, $\frac{1}{4}$ oz., $\frac{1}{4}$ oz. of glycerine, 5 ozs. of water. Mix A and D together and add the rest

Another bath is:—(A) Lead nitrate, 200 grs.; potassium ferricyanide, 300 grs.; acetic acid, $1\frac{1}{2}$ drachm; glycerine a few drops. (B) Sodium sulphide, $\frac{1}{2}$ oz.; water, 20 oz.; immerse in A first and follow with B.

Another bath is vanadium chloride, 20 grs.; potassium ferricyanide, 20 grs.; ferric oxalate, 10 grs.; ferric chloride, 10 grs.; oxalic acid, $2\frac{1}{2}$ ozs.; water 20 ozs.; glycerine, a few drops.

The negative is placed in any of the above baths until the action has fully taken place. In the case of most baths leaving the negative in them for prolonged periods does no harm, but in most cases the action should be complete in something over ten minutes. The negative is removed and washed in cold water for a few minutes, and thence transferred straight into the dye bath, or may be dried and dyed up any period later.

It should be kept in the dye bath for about ten minutes, when it is brought out and rinsed for about a minute in cold water, and then brought into contact with gelatine-coated paper, which had been previously soaked in cold water for about a minute. They may be brought into contact under water or immediately they have been taken out, when they are squeegeed together and left in contact for about ten minutes, covered with a damp cloth with a piece of glass over it, to keep them moist, at the end of which time the gelatined paper is stripped from the negative and brings the dye with it in the form of a positive in dye. The negative may then be re-dyed and used over and over again, the re-dyeing only taking about three minutes.

The latter part of the process, from the time the negative has been removed from the dye, is exactly the same as that for the impressions taken from the positive transparencies in the pinatype process.—Eng. Pat., No. 13,874, 1907; "B.J.," Jan. 10. 1908, p. 29.

C. Welborne Piper, writing of experiment with the Donisthorpe process, points out that success depends (1) on the condition of the toning solution, and (2) on the quality of the negative. The toning solution, both before and after mixing, should be kept in the dark, and the mixed solution should be used for not more than two plates, otherwise the hardening action falls off. The solution should remain quite clear during use. Cloudiness shows that it has become useless. The negative should be thin and clear, with perfectly clear shadows. Developers other than metol or amidol, recommended by Mr. Donisthorpe, were found to work well; for example, rodinal, 1 in 20, with 2 grs. of bromide per oz., gave a suitable negative.

The dyeing process presents no difficulties, with a proper negative, but if the high-lights are not dense enough too much dye is absorbed, and the result is very flat. On the other hand, if too dense the lighter half-tones will not take up any dye at all, and the result will be deficient in these tones. Fogging or veiling of the shadows again causes flat results, due to their not taking up the dye fully until the lights have absorbed too much. It was found best to blot the prints immediately on taking from the negative. The use of spirit to quickly dry the print led in some cases to bluish tints, due apparently to solution of part of the dye. Mr. Piper gives the following working instructions as a result of his experience:—

Slightly under-develop the negative, stopping development while the whites still show quite clear.

Fix and wash very thoroughly, making sure that all hypo is eliminated, and dry the negative before proceeding further.

Place for five minutes in the toning and hardening solution, then wash for ten minutes in cold water, wiping the surface of the plate with cotton-wool to remove any sediment left by the toning solution.

Put in the dye-bath for from five to about ten minutes, or until the negative, on being examined against white light, shows a strong positive image in the colour of the dye upon a green ground. The time for the first dyeing varies with the negative and the dye used, and also with the temperature of the solutions. Sometimes half an hour's dyeing may be required.

Rinse the dyed negative in cold water, wiping the surface with cotton-wool. This takes about a minute.

The gelatine paper should be soaked in water for about three minutes or less in the case of a negative that has already had prints made from it, while a longer soaking is desirable if the negative has not previously been used. The paper should therefore be put to soak soon enough to have it ready by the time the dyed negative is washed.

Bring negative and paper into contact, and squeegee the paper on to the former. This should be done as quickly as possible before the dye has time to "run" on the negative, and great care must be taken to avoid any slip of the paper when it is laid down on the negative. If any slip occurs a new piece of paper must be applied, and the negative must be again rinsed.

After a period varying from five to fifteen minutes the paper can be stripped from the negative and immediately pressed between blotting papers. It is then put aside to dry thoroughly.

For some reason not understood the first pull from the negative often sticks to it and tears, but the bits of paper adhering can then easily be rubbed off. As the first print is almost always too flat this does not matter much, and subsequent prints have no tendency to stick.

When a print has been taken the negative is re-dyed for from two or three minutes, and rinsed before the next print is made.

The time of contact in printing varies with the negative and the dye, and the amount of dye the former will hold.—"B.J.," April 10, 1908, p. 280.

PRINTS ON VARIOUS SUPPORTS.

Prints on China-Surface Metal.—W. B. Picken has patented a substitute for opal or porcelain in the shape of a thin plate of steel or other metal with a facing of vitreous china. A celluloid plate coloured white in the body or faced with china are used as substitutes for ivory. Eng. Pat. No. 21,698, 1906.—"B.J.," Nov. 1, 1907, p. 830.

Ceramic Photographs.—A. Hans prepares ceramic enamels by coating the support with bichromated fish glue, exposing under the negative, developing, hardening with a tanning agent, and fixing. The hardening process consists in treating the plate with solution of hydroquinone, which causes a deep black coloration of the image on fixing, when the tanned image is dipped for some time in a solution of logwood extract. The same effect is obtained by dipping the developed image for some time in a mixture of the hydroquinone solution and logwood extract.

As an addition to the fish-glue mixture a concentrated decoction of malt is recommended, such as a dark beer rich in malt, the latter giving great tenacity to the fish-glue coating when a mixture of both is exposed to heat.

A solution is prepared composed of 400 c.c.s. fish-glue, 40 to 60 gms. of bichromate of ammonium, and 700 c.c.s. of dark beer which is rich in malt. The support of metal, glass, or porcelain is covered with a layer of the above solution, and dried preferably by means of "a centrifugal."

After drying the support is placed with its sensitive layer under the negative, exposed, and after exposure washed with water to develop the image. After development the support, with the image adhering, is placed in a tanning bath consisting of an aqueous solution of from 5 to 10 per cent. of hydroquinone. Finally the support and adhering tanned image are fired in a (muffle) furnace, as by this way a more uniform and a more brilliant black is obtained than by firing on an open fire. Eng. Pat. No. 1,928, 1907.—"B.J.," Nov. 8, 1907, p. 848.

Mounting and Mountants.

Dextrine Mountant.—L. A. Fennell prepares the white solid dextrine mountant or "photo paste" as follows:—White dextrine, 10 ozs. by weight is stirred into 10 ozs. fluid of water contained in a jar. The latter is then placed in a saucepan of hot water, placing a piece of flannel on the bottom of the saucepan to prevent danger of cracking. The water is brought to boiling, the mixture stirred till it thickens, and cooked for another five minutes. The jar is removed from the water, 15 minims of formalin added, or 15 grs. of salicylic acid, and the whole stirred up. The mixture is now poured off into jars, and in a few hours will set to a solid white paste. If the best white dextrine is not obtainable, the following method of preparing it may be used:—

Into a jar, whose capacity should not be less than a pint, put 10 ozs. of water and 50 minims of pure, concentrated hydrochloric acid. Next add 6 ozs. of arrowroot, and stir well. Adjust the jar as previously directed, taking care that the level of the water in the saucepan is above that of the liquid in the jar. The whole should now be heated, and the mixture stirred at short intervals till it has thickened. Arrived at this stage, the jar should be covered with a saucer, and from now onwards the boiling-point must be maintained continuously for one hour. Meanwhile, stir the mixture occasionally, but keep it covered during the intervals, otherwise a tough skin will form on its surface.

While the cooking is in progress it will be noticed that the arrowroot slowly loses its thick consistency, and eventually becomes capable of being readily poured. The hour having elapsed, remove the saucepan from the fire. The next step is to neutralise the free hydrochloric acid still remaining in the solution. To this end, 1 drachm of washing soda should be finely crushed and dissolved in the mixture. It must be added by degrees, otherwise the rapid evolution of carbon-dioxide may cause the contents to overflow the jar. As a result of the reaction, sodium chloride (common salt) is formed. Now thoroughly incorporate, either 20 minims of formalin or 20 grains of salicylic acid, and the preparation is complete.—"P.N.," March 27, 1908, p. 302.

Multiple Mounting.—Frederick H. Evans, in opening an exhibition of his multiple mounted photographs at the Royal Photographic Society, gave a very complete exposition of the principles which have guided his admirable practice of this style of mounting. The chief aim should be simplicity of treatment, and, therefore, a multiple-mounted photograph should be very simply framed. There should be no competition between the frame and the mount for decorative effect. A plain, narrow moulding or a *passe-partout* is the most suitable. In choosing the colour of the outside—that is, bottom mounting paper, a tint must be selected that will enrich the dark portions of the subject, but not ruin the lighter portions. Very often a light mount will do this for a dark portrait subject, provided it is helped by one or two intermediate tints, which, as it were, break the shock between the dark print and the light sur-

round; the intermediate borders should usually be quite narrow, and in some cases, those of papers of distinct colour, should be mere lines in width. In building up the mount behind the print the practical method is to first try the effect of one or two papers, (holding them at arm's length) behind the print, so as to get a rough idea around two sides of the print of the mounting borders to be used. The print, having been trimmed perfectly square, is attached to a piece of mounting paper No. 1, with a small dab of paste at the top right-hand corner only. This one point of attachment lessens the liability of the mounting papers to cockle. The paper has now to be trimmed, for which purpose it is necessary first to mark the width to be cut away. A hard retouching pencil is used to make a small dent, top and bottom, on each side of the print, and the paper then cut away accurately to these marks with a guillotine trimmer. The same practice is followed with each successive mounting paper, in arranging which a guiding rule should be never to repeat the same widths of border one after the other. The meaningless repetition gives a monotonous effect without sense of design. Black papers and papers of distinct colour, should only be used in very narrow borders, and a good deal has to be learnt as to the effect which one light tone has in darkening another light one, whilst a too dark tone may unduly lighten another next it.—“Phot. Journ.,” Feb. 1908, p. 99; “B.J.,” March 6, 1908, p. 178.

Shellac Mounting Without Heat.—Nelson K. Cherrill recommends the following process for mounting prints without cockling on the thinnest mounts:—

Coat the back of the dry (and preferably untrimmed) print with shellac varnish, which is merely a solution of shellac in methylated spirits. When the varnish is dry the print may be mounted at once or at any future time. To mount it, all that is necessary is to rub over the surface to which it is to adhere with a small quantity of a mixture of acetone and alcohol, and to apply the print at once with a firm pressure which extends all over the surface. In two minutes the solvents will be dissipated and the mounting complete. Anything of its kind more simple or easy of execution it is difficult to imagine.

Ordinary unbleached lac is used, which is covered with methylated spirit, and then forms a solution which is thick enough for the purpose. It is filtered through two thicknesses of muslin before use. Small prints are best held in the hand when applying the adhesive.

As little alcohol as possible should be used. A satisfactory proportion is 1 part to 8 of acetone. The acetone-alcohol mixture produces no ill-effects on the paper used for mounting. It dries off without leaving marks. The pressure necessary to secure good adhesion need not be great, although it should be even. A letter-copying press answers well, but boards and weights are effective, or even a printing-frame with strong springs.—“Phot. Monthly,” March, 1908, p. 73.

Dry-Mounting by the Edges.—A. E. Rendell places the prints in a pile and applies a thin, narrow band of “Seccotine,” thinned

slightly with water, by means of a ruling pen. A rule is used as a guide, and the band of adhesive, which should be about $\frac{1}{4}$ in. in width, is applied so as to extend to the extreme edge of the print. The prints are allowed to dry, and are applied to the mounts by damping the face of the latter with a moistened sponge, laying the print down upon the moistened surface, and placing under light pressure with a piece of clean blotting-paper next to the surface of the print. The attachment of the print by this method is exceedingly firm, whilst if the print has to be removed a short soaking in water will detach it from the mount.—“Phot. Monthly,” Dec., 1907, p. 364.

Enlarging.

Enlarging Carriers—A defect from which many enlargers suffer is that the negative carrier is made to fit the wrong way about, it being necessary to re-focus every negative used, owing to the fact that the back of the negative, and not the film, falls into register against the rebate. It is just as easy to arrange for the carrier being fitted on the other side of its supporting board, and the sharpness can be relied on once proper focus has been obtained. Another fault that is often found is that there is no means of pressing the negative firmly into register in the carrier. The usual fitting is a turn-button, but what is wanted is a spring clip to press the negative against the rebate of the carrier.—“B.J.,” Jan. 31, 1908, p. 79.

Enlarging Re-touched Negatives.—When making a sharply focussed enlargement from a negative carrying much re-touching, the re-touching marks will show unless the light is very well diffused. This should be done with ground glass placed between the light and the condenser. If placed between the negative and the condenser, the diffusion effect is very slight, and there is the risk of the grain of the ground glass showing in the enlargement. If the re-touching is at all scratchy, the enlargement may be improved by putting the picture just out of focus.—“B.J.,” July 3, 1908, p. 507.

Working-Up and Colouring Prints and Enlargements.

Finishing Bromides.—H. A. Eaton recommends water-colours for the working up of bromide prints which are afterwards to be waxed, a process which dispenses with the use of pencil or crayon. The work should be done by daylight, and a supply of water-colours procured, including a black, a sepia, and two or three tones of brown. Mixtures of these will permit of the tones of bromides being imitated. Water is added until the paint is fairly weak, and pure gum-arabic solution then added to thicken perceptibly. The work should be done by applying a succession of paint washes.

In waxing the prints it is a good plan to make an iron-plate fairly hot by placing it on a small ring gas burner. Half-a-dozen thicknesses of newspaper are placed on the plate, and on them the bromide print, into which the waxing preparation, such as “Lustralene,” has been rubbed. The wax then melts, and on further rub-

bing with a piece of old fluffless linen is given a smooth surface, while the print has the thinnest possible coating of wax. The results of this hot process are described as possessing much more lustre and richness of effect than those of the cold.—“Focus,” Jan. 22, 1908, p. 108.

Colouring Photographs.—W. J. T. Barker has patented a method of colouring photographic prints on paper which consists in applying to the surface coloured waxes, which may afterwards be fixed and blended on the print by warming the latter on a metal plate and dabbing with a badger or other softer as in oil painting. To prevent absorption of the wax colours, the print may be first painted over with a solution of pure white gelatine, being then squeegeed to ground glass and stripped off when dry. The surface is then matt and impermeable to the wax colours.

The special feature of the process consists in its combination of the properties of water, oil, and pastel painting. The dissolved wax and colour can be laid on in broad washes as a water-colour; when dry it can be softened by heat, strong touches added, and then be softened and worked up like a recently laid-in oil painting; or colour in powder may be applied like pastel and fixed by heat, and all this in no way affects the underlying photograph or print, which is quite unaffected, and can be recovered at any time by cleaning off the waxen film with a solvent, when the portrait will be found uninjured if the gelatine protecting film be everywhere, as it should be, impermeable. Moreover, the drawing everywhere shows through the transparent film of wax, etc.—Eng. Pat. No. 15,249, 1907; “B.J.,” July 31, 1908, p. 590.

LANTERN SLIDES.

Warm Tones with Diamidophenol.—M. Balagny has worked out the use of this developer for the production of a range of warm tones on gelatino-chloride lantern plates (Ilford and Edwards).

For an average negative $1\frac{1}{4}$ inch of magnesium ribbon burnt at 8 inches distance from the printing frame is usually sufficient, and this length of ribbon may be adhered to, altering the distance from the frame for greater or less exposure. For average good negatives this range of distance need not be greater than 2 to 4 inches for dense, and 12 to 15 inches for thinner negatives. For development the light of an oil lamp or candle may be used instead of any yellow or orange lamp, although, of course, the incandescent gas-light and similar white artificial light are not permissible, but for these a screen of ordinary white paper may be employed.

The ordinary solution S., already given (see “Negative Processes-Developers”), is made up in sufficient quantity. The developer consists of:—

Diamidophenol	1 gm.	8 grs
Solution S.	8 10 c.c.s.	135-170 mns.
10 per cent. ammonium bromide solution	10 c.c.s.	170 mns.
Sodium bisulphite solution	5 c.c.s.	85 mns.
Water	175 c.c.s.	6 oz.

This solution is well mixed, and employed with the precaution that a dish free from previous use of alkaline developer be used. The development at the commencement gives up image of red colour, which changes gradually during development in the direction of sepia. Thus, if one so exposes that the colour is too red at the commencement, the right density will be reached before the red has been sufficiently removed from the deposit. On the other hand, if the transparency is too black to start with, there is no chance of it reaching a sepia tone when the end of development as regards density is reached. It will be found that while it is possible to force development from red to get the black or greenish-black, one can never work in the opposite direction and obtain red when working from a black deposit.

The sepia tones once lost can never be regained again. It is, therefore, necessary to time exposure correctly, and to work to time. The use of ammonium bromide instead of potassium bromide is of great advantage in avoiding greenish-black colours. These latter arise from a too active bath, whilst the best tones are obtained by a long exposure and the use of a fairly active, but weak, bath. Too short exposure will give the greenish-black tone, and it is therefore necessary to adjust the exposure to the character of the developer. In all cases the slides obtained have very great transparency; the high-lights are absolutely bare glass, resembling those of an albumen slide. There is no need to back the plate, as is frequently done when alkaline developers are used.—“B.J.” (from “*Monographie du Diamidophenol en Liqueur Acide*,” published by MM. Gautier-Villars, Paris), July 24, p. 569, 1908.

Warm Tones by Development—Thomas Bolas, reviewing the modern formulæ for the making of warm-tone lantern-slides directly by development, recommends the ancient formula of Eder and Pizzighelli as still without equal, whether for bromide, gaslight, or pure chloride plates, or papers:—

Water	100 volumes
Alcoholic solution of hydroquinone, 1 in 20 ..	4 volumes.
Sodium chloride solution, 1 in 30	12 volumes.
Ammonium carbonate solution, 1 in 30.....	20 volumes.

This developer is slow in its action, and tends to intensity, so in its nature it is favourable in cases of over-exposure. If compounded as indicated above it is suited for exposures that are three or four times the minimum correct exposure, and with this exposure it will give a reddish or reddish-yellow tone on a pure chloride paper, but to obtain a similarly warm tone on the usual gaslight papers, a longer exposure will be necessary and an increase of the sodium chloride. For pure bromide papers even a tenfold exposure and a quadrupling or tenfolding of the sodium chloride may not in all cases suffice to give a fully warm tone, but sepia tones will involve less exposure and less restraining.—“A.P.” Sept. 1, 1908, p. 201.

Window Transparencies.—For producing an opalescence which dispenses with the use of ground glass behind the transparency, and at the same time gives a rich tone to the picture, Dr. John Bartlett, immerses the plate in the following:—

Iodide of iron.. . . .	1 dram.
Water	16 ozs.
Iodine (alcoholic tinct.)	6-8 drops.

which is used after removal of the hypo by washing.—“Bull Phot.,” Jan. 8, 1908, p. 22.

Diachrome Toning—Dr. A. Traube has patented the conversion of the silver image into silver iodide, and the subsequent staining of the iodide with a dye. Slides treated in this way can be given a variety of tones, depending on the selection of dyes. A suitable dye is quinoline red in 1 in 2,000 solution. If the silver iodide is to be removed in a fixing bath, the latter must contain a substance to fix the dye, namely, tannin for basic dyes and metallic substances for acid dyes. Potassium iodide will answer with other dyes, the principle being to add a substance which gives an insoluble coloured substance with the dye. Eng. Pat. No. 10,258, 1907.—“B.J.,” June 5, 1908, p. 35.

Dr. F. Novak mentions one or two dyes which he has found to act effectively on the image of the lantern-slide or transparency which has been bleached in, say, a solution of iodine in potass. iodide. Among these dyes are:—Methyl green, brilliant green, Turkey blue, rhodamin B., chrysoidin, methylene blue, malachite green, crystal violet, and auramine. Solutions of any of the above are made in water—the strength is not very material—and the bleached side allowed to soak until of full intensity. Basic dyes are best for the process, as a weak bath of acetic acid completely clears the gelatine of them. The slide can be left with the silver iodide in the film or the latter fixed out, for which latter purpose some tannin and sodium acetate should be added to the 10 per cent. hypo solution in order to fix the basic dyes. “Phot. Korr.,” June, 1908, p. 276.—“B.J.,” June 12, 1908, p. 446.

Ozobrome Lantern Slides.—In recommending the Ozobrome process W. Findlay gives some hints as to the most suitable pigment tissues to be used. All do not show equally well through the lantern. Various shades of green, so suitable for landscape-work, do not give the depth one would wish to see. Red chalk conveys a realistic impression of a sunset, and makes a very satisfactory slide. Sepia is likewise a colour that can be recommended. Engraving-black is also suitable for slides; and although transparency pigment is more suitable as an intermediary in making an enlarged negative, it gives a marvellously soft effect from a print strong in contrasts.—“Photo-Era,” Feb., 1908, p. 84.

Diagram Lantern Slides.—Diagrams are best drawn on Bristol board with Indian ink made, as a draughtsman makes it, by rubbing the stick with a little water in a proper china palette. Using backed process plates, which are the best for the purpose,

a suitable developer is hydroquinone and caustic soda containing 2 grains of bromide per ounce. This is used for three or four minutes, and after fixing, the negatives cleared in a strong Farmer's reducer, being dipped therein for a moment and immediately rinsed under the tap. When laid on white paper the lines should show up quite clearly.

When making diagrams it is a good plan to surround each with a wide, black border, which then serves as a guide when masking the lantern slide with strips of paper.

It is worthy of note that the thickness of the lines on the slide depend a good deal on the exposure. Over-exposure gives an halated line, but before halation appears the line grows rapidly in thickness, while remaining quite sharp. A very thick line negative will therefore stand a short exposure in printing, while a fine line negative will give the best result with a longer exposure—say, half as long again.—“B.J.,” July 31, 1908, p. 578.

Lantern Slides Direct in the Camera.—Douglas Carnegie has worked out the following method of reversing the negative image obtained on a lantern or “process” plate in the camera so as to obtain the necessary clearness of ground:—

The plates (backed) are exposed in the usual way, but may be slightly over-exposed with advantage; under-exposure is fatal to the success of the process.

Develop in a solution—*e.g.*, metol-hydroquinone containing soda sulphite—giving a strong, hard negative, wash in three or four changes of water, and place for about two minutes in:—

Potass bichromate	150 grs.
Nitric acid (puriss)	90 minims.
Water	20 ozs.

In warm weather this “reversing” bath should be diluted with an equal or double volume of water, else opalescence, due to a curious pitting of the gelatine, is apt to supervene. A pitted plate may, of course, be made presentable by varnishing; but the drying of varnish is always a very slow process, and time is saved by making a fresh negative. After about two minutes in the “reversing” bath the silver from primary development is all dissolved; the plate is given a *momentary* rinse under the tap, and its surface lightly stroked with a mop of wetted cotton wool. (The bichromate solution is *not* washed out of the film.) The plate is now returned to the already used developer, rocked therein for half a minute, and then, while still under the developer, exposed to light.

Give a momentary rinse under the tap and wipe the surface lightly with wet cotton wool—*i.e.*, do not wash the bichromate out of the film. Place back in the developer, rock therein for about 30 seconds, and then, while still under the developer, expose to light, say, for 20 or 30 seconds from an ordinary No. 4 burner held a foot or so above the developing dish.

The portions of the plate protected during primary exposure by the rebate of the dark-slide are the first to blacken, then the positive image appears and slowly gains density. It is essential that this secondary development of the plate be not pushed to the point of

fogging of the background, for any background veiling that may form in this process is not (as in contact printing) on the surface of the gelatine, but deep buried within the film, and it is almost impossible to remove it without at the same time wiping out the more superficially disposed positive image.

To avoid stains it is essential that the plate should not be fingered between the several stages of the process. The plate should either be manipulated with a plate-holder, or preferably all treatments and rinsings up to the final hypo bath should be performed without removal of the plate from the dish, which, for safety's sake, should be made of a dead-black material. After removal from the developer the plate is plunged forthwith into an acid fixing bath, cleared by *momentary* immersion in a very *dilute* Howard Farmer reducing bath, and then washed.

It will be gathered from the fact that no intermediary *thorough* washings, sulphite baths, etc., are involved, that the process is a very rapid one. If there is urgency, the final washing out of the hypo may be hastened by placing the plate for a few minutes in 10 per cent. formalin solution, washing with four or five changes of boiling water, and then drying on a whirler.

The action of the bichromate on the image results in the formation of a reddish compound, which acts as a screen towards the silver bromide lying underneath, and thus enables this latter to develop clear in the second developer, whilst the other portions of the image which are not thus protected are affected by the exposure to light, and thus give an image of sufficient density in the second developer. This and other causes are responsible for the satisfactory results obtainable.—"B.J.," Oct. 23, 1908

LANTERN PROJECTION.

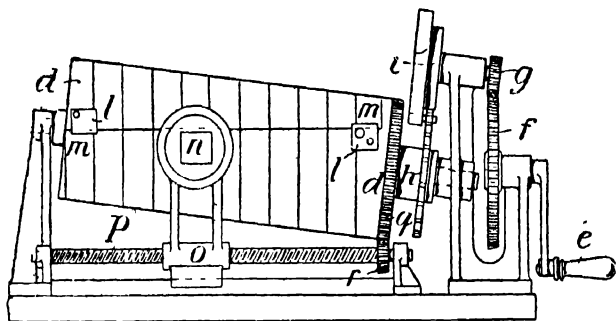
Dew on Lantern Slides.—J. Robson prescribes a remedy for the condensation of moisture on lantern slides in the shape of a space of about 1/16th of an inch between the slide carrier and the wooden front carrying the condenser. This can be done by screwing four round-headed screws in the wooden front so that the slide carrier when in position rests against the screw heads. If the front of the lantern is of metal, four pieces of wood may be glued on to the carrier, one at each corner.—"B.J.," Jan. 3, 1908, p. 13.

The slow appearance of the dew and its equally slow disappearance points to the fact that the moisture is carried into the lantern by the slide itself in the gelatine and the paper binding.—"B.J.," Jan. 17, 1908, p. 36.

CINEMATOGRAPH.

Cinematograph Portrait Prints.—H. Voss has devised a system of making series of cinematograph exposures, the positive prints from which are all obtained on a single sheet of paper which can be

wound round the cylinder of a viewing machine, and a reproduction of the "sitter's" movements obtained on rotating the cylinder.



The figure shows a drawing of the viewing instrument.—"Photograph," April 3, p. 103; "B.J.," April 24, 1908, p. 330.

Fire-proof Celluloid Films (See under "Materials," Section II.).

(Space will not permit of reference to the numerous patents for cinematograph cameras and projectors. The specifications are published or abstracted in "The British Journal of Photography," and entered in the annual index of that publication under (1) *Cinematographs* and (2) *Name of Patentee*.)

VI.—COLOUR PHOTOGRAPHY.

Patents for Colour Photography.—The chronology of the patent specifications relating to colour photography commenced in the monthly "Colour Photography," Supplement to the "British Journal of Photography," is concluded with the issue of December 6, 1907, p. 96.

A Colour-Screen Meter—F. E. Ives has described a simplified form of the colour-screen meter in which diffraction gratings were used (see "B.J.A.," 1908, p. 713). He now uses a set of three rectangular colour screens passing pure red, green, and blue violet, and a revolving wheel of convex lenses which optically mixes these colours to the eye in the field of the instrument.—"Journ. of the Franklin Institute," "B.J." (Colour Supplement), March 6, 1908, p. 19.

A Green-Light Carbon—E. J. Wall, by using a carbon cored with a mixture of silver and copper (in the proportion of their molecular weights), has obtained a green light which, it is suggested, should be useful in three-colour work.—"B.J." (Colour Supplement), April 3, 1908, p. 28.

Atmospheric Light.—C. L. A. Brasseur quotes Plicht and Stenger's results ("B.J.A.," 1906, p. 868) on the variation of the actinic quality of daylight, and lays stress on the necessity for measuring the quality of light and making the necessary correction in three-colour work.—"Camera Work," Oct., 1907, p. 35; "B.J.," Nov. 8, 1907, p. 843.

G. Woodriss has patented the use of a method of preparing four printing blocks for reproduction in colours, employing for the purpose a set of three-colour negatives and a four-colour bleach-out tissue.—Eng. Pat., No. 5,692, 1907; "B.J.," March 20, 1908, p. 220.

Direct Interference Processes (Lippmann.)

The Lippmann Process—Experiments by Herbert E. Ives, recorded in a paper before the American Physical Society, have shown that the non-formation of laminae at a distance from the surface of the film is due to the kind of developer ordinarily used—pyrogallie acid. This is brought out by sections made of the films, which, wetted so as to swell, are examined with the microscope. It is found that the photographic action extends through the thickest films practicable to flow. By using other developers, such as hydroquinone, even action throughout the film results. If the developed image is then bleached with mercuric chloride a transparent deposit is obtained, and the reflected light consists of a spectrum band of only a few A.U. in width, the purity increasing with thickness of film.

A substitute for the mercury mirror has been found. Celluloid

varnish is flowed on silvered glass; on drying, the celluloid and silver strip off together. This flexible mirror is then laid on a wet Lippmann film and set to dry. Exposure is made as with dry plates, the celluloid stripped off, and film developed.—“B.J.” (Colour Supplement), August 7, 1908, p. 60.

Three-colour Processes.

APPARATUS FOR THREE-COLOUR PHOTOGRAPHY.

One-exposure Cameras.—Dr. C. E. K. Mees has described his arrangement of plates and filters for the Butler one-exposure one-lens three-colour camera (“B.J.A.,” 1906, p. 855). As shown in the drawing, he retains Mr. Butler’s principle of making the reflector in each case complementary to the taking filter. With the arrangement shown the same plate is used throughout—namely, one sensitised with pinacyanol. It is important to use a plate sensitised with only one dye, as its sensitiveness to the different parts of the spectrum will then be much more constant than when several dyes are employed, and the drawback to the one-exposure type of camera is that alteration in the ratio of exposures cannot be made. As pinacyanol gives a plate which is not very sensitive to green, the green-sensation negative is made direct.

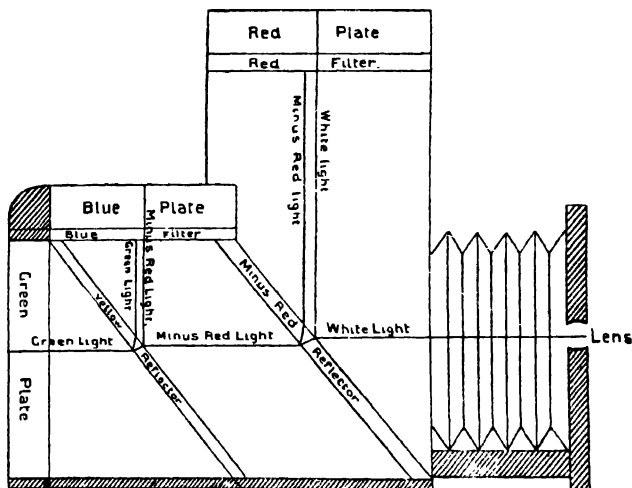
Equal focus on the different plates is obtained by altering the position of the reflectors. Raising the latter shortens the central beam of light.

In order that the size of the images shall be identical, not only the optical paths but also the path in glass must be equal. For this purpose the thickness of the filters must be adjusted so that the length of glass through which each beam travels is equal. The length of the glass through which the direct beam travels is equal to the thickness of the two reflectors taken at an angle of 45° to the axis of the lens. That is to say, it is 1.41 times the actual thickness of the reflectors. The thickness of the red filter is, therefore, equal to 1.41 times the thickness of the two reflectors, while the thickness of the blue filter will be 1.41 times the thickness of the yellow reflector.

In order to adjust the colour of the filters so that the correct ratio is obtained, pieces of film are put between the glasses and a black and white chart photographed, altering the depth of the film until equal exposures are secured on the three filters. The films were then cemented in the glass, and the positions of the filters adjusted until all three images were in focus at the same time. If the work is properly done this single-exposure camera presents us with the best method as yet available of making three-colour records.

With regard to inequalities in the cemented filters, Dr. Mees said that if two images could be seen in the filters it was usually a sign of the badness of the filters. A good deal depended, however, upon the length of time that the filters had been cemented. Filters at first showed distortion, but in most cases the distortion did not persist. The plan he employed in testing the glass was to get a piece of black paper and cut it into segments, the clear spaces

between each segment forming a kind of star. He then bound them up like a lantern slide, put them in the enlarging camera, held the glass at about 45° , and looked for the double image. Ordinary thin parallel plate gave two images separated from each other. This was due to the fact that the glass was not really parallel, but wedge-shaped. A slight appearance of opening and shutting did not



matter, but if the effect was very marked over the surface it proved the glass to be bad. In the case of newly made filters this open and shut effect was almost always apparent, owing to strain. It generally disappeared in the course of a week or a fortnight, the glass seeming to recover from the strain as the balsam distributed itself more evenly.—"Phot. Journ.," July, 1908, p. 276; "B.J." (Colour Supplement), Aug. 7, 1908, p. 58.

Three-colour Cameras.—J. S. Chenhall has patented a camera in which plates are exposed automatically in succession for given periods. The plates with their colour-screens are carried in ordinary plate-holders, which are inserted in grooves in a disc-shaped carrier pivoted at the rear end of the camera.—Eng. Pat. No. 22,310, 1906; "B.J.," Nov. 1, 1907, p. 830.

According to a German patent, No. 185,347, 1906, granted to W. Schwechten, a repeating-back for three-colour work is arranged on ball-bearings to allow of the smooth and rapid substitution of the filters.

According to patent No. 185,345 of 1905, granted to H. Boekholt, a roller-blind device is used for changing the plates in a three-colour camera.—"B.J." (Colour Supplement), Dec. 6, 1907, p. 94.

Three-colour Projection.—Otto Pfenninger has patented "prismoids," four-sided prisms of special shape, for the purpose of compensating for optical errors when making three negatives at one exposure with a one-lens camera. The same "prismoids" are likewise used when projecting three three-colour records (transparencies) with one lens. The details of construction of the "prismoids" require the full patent specification for their explanation.—Eng. Pat. No. 15,726, 1907; "B.J.," July 31, 1908, p. 570.

Three-colour Process.—A method of colour photography suggested in 1899 by Mr. Fricse Green, and consisting in the provision of a rotating disc before the lens, which disc was made up of red, blue, and green sectors, has been patented by B. S. Philbrook, though it is difficult to understand how the bichromate printing process, described in the specification, is employed in connection with a negative or transparency which would appear to be identical with one taken in the ordinary way on an ordinary plate.—Eng. Pat. No. 10,611, 1907; "B.J.," Aug. 7, 1908, pp. 598 and 607.

The Dani-thoupe Process.—For particulars of this process of preparing prints by contact only with a negative which has been treated so as to absorb dye in the undeveloped portions, see under "Miscellaneous Printing Processes."

ONE-PLATE THREE-COLOUR PROCESSES.

SCREEN PLATES, RASTER-PLATTEN. "RÉSEAU-PLAQUES."

Screen-Plate Processes.—Dr. C. E. K. Mees, in a lengthy paper before the Society of Arts, has dealt with the processes of screen-plate colour photography suggested since Du Haumont's first publication in 1868. These include the methods of Joly, Brasseur, McDonough-Joly, Lumière, Powrie, Krayn, Dr. Smith, Berthon and Gambs, Finlay and Palmer. A method used by the author for preparing experimental screen-plates of coarse ruling is to coat a sheet of glass with bichromated gelatine on the ordinary coating machine, and expose this glass under a line-screen having the black line one-half of the width of the space. In this way two-thirds of the width of the screen becomes hardened, the lines covered by the black screen line remaining soft. This soft line is then dyed up with one of the many dyes which do not penetrate hard gelatine, and after drying, the plate is again coated with bichromated gelatine, the second and the third line being put on in the same way.

It was explained that the screen-plate being an additive process, the conditions for taking filters are as follows:—The red should be a sharp-cut filter transmitting the scarlet and orange to, say, 5,800 A.U., but not transmitting the green or blue. The green filter should overlap the red, and also to a somewhat greater extent the blue; if the filter extends from 6,000 to 4,800 we may regard it as satisfactory. The blue filter should not transmit red, and if the dye

used in it absorbs the ultra-violet to some extent, there will be less difficulty in making the compensating filter. The blue filter should transmit from 5,000 to 4,000.

If the screen-plate is to be turned into a positive, these will be also the projecting filters, and for projecting filters the conditions are different. In order that strong colours should be obtained when using projecting filters, it is necessary that the spectrum cuts should be fairly narrow, and, if possible, they should not overlap.

Overlapping projecting filters will give distinctly washy colours, diluting pure colours with white, so that in manufacturing a screen the fact must be remembered; and in practice if we are to reverse our screen-plate and turn it into a positive, the filters must be a compromise between the taking and projecting filters. Probably the best compromise is that the filter zones shall touch but not appreciably overlap; this is realised in the Autochrome plate.

The author described a method of testing the filters of a screen-plate by means of the micro-spectroscope attached to a camera.

Referring to the conditions limiting the fineness of a geometrical or irregular screen-plate, the first is the *thickness* of the dye substance itself, which, if great in relation to the *width* of any given filter unit, will give rise to errors in the case of rays striking the plate at an angle, owing to a ray passing through two different coloured grains or filter units. In the case of the Krayn plate, a limiting condition is the difficulty of colouring the celluloid with sufficient intensity, a thinner celluloid section requiring greater intensity of colouring. In the case of gelatine the author placed the limiting fineness of lines at 1,000 per inch, corresponding to 1 c.c. of 5 per cent. gelatine solution per 20 sq. cm. As regards the limit imposed on the fineness of a screen by the size of the emulsion grain, the author based his calculation on the diameter of the average grain of a plate (equal 1/1,000th of a millimetre), a dimension which allows of a very fine screen indeed.

As regards sensitising conditions, the author thought that the maximum speed of a screen-plate when ready for exposure might be placed at 5 Watkins, which figure is obtained by assuming a panchromatic emulsion of 240 Watkins, and a multiplying factor of the filter-screen of 20, a compensating filter again doubling the exposure. The reversal method of preparing the positive colour result on the same plate on which the exposure was made called for a thin film of necessarily small latitude. It was possible that the thiocarbamide method of reversal by development in the first instance might be successful, but it was difficult to get a satisfactory black image.—“Journ. Soc. Arts,” Jan. 17, 1908, p. 195; “B.J.” (Colour Supplement), Feb. 7, 1908, p. 12.

Szczepanik Screen-Plate.—Jan Szczepanik prepares a three-colour screen-plate by impressing coloured lines either upon the support of the emulsion or upon the sensitive layer itself in such a way that the primary colours lie one above the other and cross each other.

The process is suggested as suitable for the making of screen-plate prints on paper, in which case a thin, transparent coating is

first applied to the photographic film and the mosaic impressed upon the former. If necessary, development can take place through the mosaic.

The conversion of the negative into a positive, or of the positive into a negative, can easily be effected by this process, provided the coloured mosaic be placed upon a very slightly sensitive photographic coating—for example, upon a print-out or copying layer—and if upon this coating there be applied a panchromatic emulsion adapted to be easily stripped. As the coating of print-out or copying emulsion is almost non-sensitive in comparison with the panchromatic emulsion, little effect can be produced therein during the exposure to light. The panchromatic coating will be fixed as a negative if a positive be copied, thereupon the plate is exposed to the light in such a way that the negative appears on the printing-out or copying coating as a positive, whereupon the negative is stripped off and the positive present underneath is treated further—i.e., developed, toned, and fixed, or the like.—Eng. Pat., No. 6098, 1907; “B.J.,” Nov. 1, 1907, p. 829.

Sanger-Shepherd Screen-Plate.—E. Sanger-Shepherd has patented the following process for preparing colour screen-plates without registration. A series of lines covering one-third the area of the plate is first printed on the plate, say, by the fish-glue process, and a sensitive film applied over the surface thus coated.

Next, a series of, say, green lines is printed crossing the red lines at a suitable angle, using a negative in which the black and white lines are of equal width; instead, however, of placing the negative on or in contact with the coated side of the plate, we print through the glass or film so that the lines first printed form a portion of the negative, the result being that although the proportions of black to white in the negative used are equal, the printed area, owing to the interposition of the previously printed line, is only one-third of the total area of the plate.

After development the plate is recoated and exposed to light through the glass, the red and green lines previously applied acting as the negative to cover two-thirds of the area, the remaining one-third being coloured blue.

In printing, the colouring matter may be incorporated in the fish-glue solution or the solution may be clear and the prints subsequently stained; in the latter case an insulating film of celluloid or other suitable varnish may be used.—Eng. Pat., No. 20,384, 1907; “B.J.,” June 12, 1908, p. 459.

Wratten Screen-Plate.—C. E. K. Mees and Wratten and Wainwright have patented a method of making a screen-plate from a grating by one printing only. The screen or grating from which they work is composed of lines, dots, etc., of three kinds—namely, black or opaque, semi-opaque, and clear. There is thus only one printing operation, the fixation of the three colours being obtained by differential staining. A glass plate is coated with a solution of gelatine, fish glue, albumen, or other colloid containing a strong solution of a blue dye—for example, patent blue. This film or coating is sensitised, say by the addition of bichromate to the solu-

tion, or by the immersion of the plate in bichromate solution after coating. The plate thus coated is exposed to light, preferably daylight or the light of an electric arc, beneath a printing screen of graduated opacity, and conveniently consisting of a number of sets of lines, each set comprising a black or opaque line, a semi-opaque line, and a clear line. This printing screen may be made in any convenient way; for instance, by photographic means from a ruled screen which has black lines of twice the width of the clear spaces or lines, this ruled screen being printed in two operations with a shift equal to the width of one line between the two printing positions.

The exposures in these two printing operations are of different duration, to produce in one case a very dense or black line, and in the other a semi-opaque or grey line.

After printing beneath the screen of graduated opacity, the plate is washed until the blue dye is completely washed out of the lines which have been protected by the black line in the printing screen, and partially washed out of the lines which have been partially protected. The result is that the coating bears a number of sets of lines, one of each set being strongly blue, another—the partially washed-out one—a blue green, whilst the third line is clear.

The plate is now soaked for a sufficient time in a yellow dye of such a nature that it will soak only into soft gelatine, dyes of this description being well known. As a result, the blue line, which consists of hardened gelatine, remains blue, the blue-green, partially soft line becomes pure green owing to the addition of the yellow, and the clear line becomes strongly yellow.

The plate is then soaked in a solution of a deep red dye, such as carmine. This dye penetrates only into the soft gelatine or yellow line and turns it into scarlet. Thus the screen finally comprises sets of three lines in juxtaposition, the lines being respectively scarlet, green, and blue. The lines can, of course, be of any required fineness, the degree of fineness being governed by that of the original ruled screen.

On coating the colour-screen thus made with an emulsion which is rendered panchromatic, the plate can be used for direct photography in colours in the manner now well known.

Although it is preferred to commence operations with a film deeply stained with one of the colours, yet the invention may be carried out by performing all the staining operations after the printing of the sensitised colloid film. In such a case the first staining would be by a dye which only stains hard gelatine—for example, a chrome mordant dye. This would stain the fully exposed line and partially stain the medium line, but would wash completely out from the soft line. The two subsequent staining operations could be carried out in the manner previously described.

Again, by selecting suitable dyes, the staining operation may commence with a dye which stains only soft gelatine, and may end with one such as a chrome mordant dye that acts only upon the hard gelatine.—Eng. Pat. No. 28,406, 1907; “B.J.,” July 31, 1908, p. 589.

Lumière New Screen-Plate.—According to a French patent taken out by the Lumière Bros., the following process is used for the making of a screen-plate of regular geometrical design:—

(1) Two-thirds of the surface of the plate is covered with a greasy ink, which serves only as a temporary resist, and may therefore be of any colour. This application can be made in the form of lines, points, or grains. Fig. 1 shows this first ink coating in the form of equidistant lines *a a*, indicated by cross hatching.

(2) The portion of the surface not protected by the lines is dyed with a suitable solution of colouring matter, violet, for instance.

(3) The whole surface is then varnished with a preparation which must fulfil the two following conditions:—(a) The solvent employed in making it must not dissolve the greasy ink before mentioned. (b) The resin or other substance which forms the basis of the varnish must be insoluble in liquids which dissolve the greasy ink—that is to say, if the ink employed contains linseed oil, and the varnish is made of resin previously extracted by ether and dissolved in alcohol, the solvent of the varnish, alcohol, will not dissolve the greasy ink, and after it has evaporated will leave the whole surface covered with a thin film of resin. This film, in the parts where it is in contact with the greasy ink, tends to mix with the latter on gentle heating.

If the plate is next treated with a solvent of the ink in which the varnish base itself is insoluble—that is to say, with sulphuric ether—a slight friction will remove all the ink as well as the resin which covers it, and will leave on the surface of the plate only the resinous lines covering the parts which have been dyed violet. The structure of the plate at this stage is shown in Fig. 1, where *w w* represents the series of violet lines covered with varnish, and *a a* the portions of the unaltered plate from which the ink has been removed.

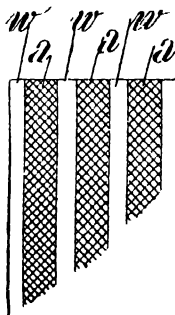


Fig. 1.

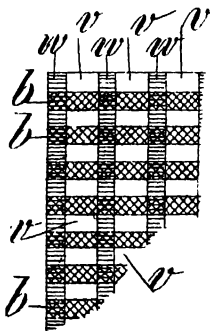


Fig. 2.

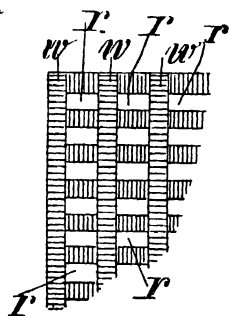


Fig. 3.

(4) A second application of ink is now made over half the total surface, say, in the form of the horizontal lines *b* shown in Fig. 2, or in any other way. The plate is then stained green, this dye in the present case being absorbed in the rectangular spaces marked

v v v, being prevented from reaching any other part of the plate by the lines of ink on the one hand and the lines of varnish on the other.

(5) The whole surface is again varnished, the solvent again applied, and the ink removed as already described in (3). We then have, as shown in Fig. 3, one third of the surface coloured violet indicated by the horizontal hatching, and another third coloured green as indicated by the vertical hatching, the remaining third of the area of the plate being uncovered. The coloured surface being protected by a varnish, the whole plate can now be dyed in the red colouring matter, and it is then complete.

(6) The whole surface of the plate is then washed by means of a solvent of the varnished base, such as alcohol, and a protective film of rubber then applied in order to prepare the plate for the application of the sensitive emulsion.

In short, the invention consists in a process of preparing polychromatic screens for direct colour photography as follows:—Each successive fraction of the surface of the screen is dyed with a different colour, whilst the rest of the surface is protected partly by an application of ink and partly by a varnish covering the colour or colours previously applied. This varnishing is rendered possible by the choice of the constituents of the varnish, which must be such that the solvent of the resin employed does not dissolve the ink, whilst the resin is insoluble in a solvent of this ink.—“B.J.” (Colour Supplement), Aug. 7, 1908, p. 57

Dufay Screen-Plate—According to an English patent applied for by M. L. Dufay, a process of making a polychrome screen-plate has been based upon the following operations:—A print is made on a bichromated gelatine plate from a negative or grating of opaque and transparent bands. This print, after development, is dyed in a bath of suitable colouring matter, and is then inked up with greasy ink, after the manner of ordinary collotype printing. There is thus obtained in the exposed parts of the bichromated print a greasy impression, and in the non-exposed parts a, say, red colouring matter. This plate is then applied by pressure to a surface coated with plain gelatine. As a result of this contact the greasy ink transfers itself to the gelatine surface, whilst the dye in the inter-spaces penetrates into the substance of the gelatine itself. We have thus a series of lines (supposing this form of sub-division of the surface to have been adopted) covering, say, one-third the area of the plate with the red filter, whilst the remaining two thirds is covered with opaque lines of greasy ink. Before these latter have completely dried, a varnish, incapable of affecting the ink, is applied, and when the whole plate is dry turpentine or similar solvent of the ink is applied, so that both ink and varnish are removed and the plate left with one-third of its area covered by the red filter elements protected by a varnish coating.

A second bichromate printing followed by the above series of operations gives, say, the blue portions of the screen, and lastly the whole screen is placed in a green dye bath, in which the unprotected parts are dyed of this latter colour —“B.J.” (Colour Supplement), July 3, 1908, p. 51.

Krayn Screen-Plate and Screen-Plate Prints.—Robert Krayn has taken out a further patent in connection with the method of making and using multi-colour screen plates as specified in patent No. 1,558, 1906 ("B.J.," July 6, 1906; see also "B.J.A.," 1908, p. 581). The patentee now proposes to produce from these line screens others which are composed of a number of coloured points. This is done by uniting line screens (of a thickness equal to the thickness of their lines and produced in accordance with the previously mentioned methods) so as to form a homogeneous block, which is then cut into sections transversely to the lines of the layers of which it is composed.

The invention makes it possible to produce positives, which appear as coloured photographs, when seen from above, so that they make the impression of naturally coloured pictures on paper.—Eng. Pat. No. 495, 1907; "B.J.," Jan. 17, 1908, p. 44.

R. Krayn has also patented a further process of preparing celluloid sections consisting of bands of the three primary colours, but with a proportion of white substance, such as porcelain, in the body of the celluloid.—Eng. Pat. No. 2,213, 1908; "B.J.," April 24, 1908, p. 330.

Dr. Stenger, in alluding to the patents of O. N. Witt and R. E. Liesegang in 1889 for a process similar to that of Krayn (see "B.J.A.," 1908, p. 581), deals with the method of the Deutsche Raster Gesellschaft of producing film screen-filters of 180 lines per inch. As regards their use for cinematograph work, he demands a screen of at least 500 lines per inch, in order to obtain the necessary fineness on the screen. A 180-line screen, projected as a cinematograph positive, with 80 to 100 times magnification, would have bands of 14 mm. breadth. He doubts the possibility of preparing such screen-films of celluloid, and further queries the possibility of their being strong enough to stand the wear and tear of the cinematograph projector. Another point is the thickness of the colour band in reference to its width. As a cinematograph film must be at least .1 mm. thick, and if the colour bands are only 1.20 mm. broad (1/500 inch), as they require to be, great error, due to parallax, is bound to occur.—"Phot. Chron.," Feb. 16, 1908, p. 87; "B.J." (Colour Supplement), March 6, 1908, p. 23.

Intaglio Printing Screen-Plates.—The German patent, No. 197,610, of Dr. J. H. Smith, Dr. W. Merckens, and H. B. Manissadjian for the preparation of colour-screens for photographic purposes deals with the making of mosaic colour-plates by a process of intaglio printing, it being found that the methods of typographic printing are incapable of giving the necessary intensity and covering power of the colours. The following is described as an advantageous method of carrying out the process:—Soft paper containing as little size as possible is coated with gum arabic, or a similar easily soluble substance, and a soft collodion film applied thereto. The colour mosaic is printed on this substratum, and is afterwards transferred to glass. The transfer to glass or other transparent support is done by squeegeeing the paper in a wet condition, and

subsequently stripping it away. The screens so obtained on the transparent support were coated with a panchromatic emulsion. It is also possible to print on the so-called stripping paper, and to transfer the screens so obtained in the usual way on to a transparent support. In this case there is no special film as the carrier of the screen, and thus the difficulty that parts of the screen may separate cannot occur. The advantage of the above-described method lies in the fact that an extremely thin collodion film no thicker than 1-100 mm. can be used, and it dispenses with a special protected film between the screen and the emulsion.—“B.J.” (Colour Supplement), June 5, 1908, p. 45

Other Screen-Plates.—A German patent, No. 197,749, of March 7, 1907, has been granted to the Vereinigte Kunstseide Fabriken of Kolsterbach a/M. The process appears to consist in the production of a screen by superimposition of sheets of gelatine, the whole block, before cutting the screen, being subjected to strong pressure by which each sheet of celluloid is squeezed to a thinner substance.—“B.J.” (Colour Supplement), June 5, 1908, p. 45

A German patent, No. 190,349, sealed in 1906, has been granted to Georg Rothgiesser, of Berlin. A line screen-plate is fastened to a light-sensitive film or plate, and exposure made in the camera through the linear plate. The negative is then developed, fixed, and dried in the usual way. A second sensitive film is placed with its support in contact with the linear plate, so that the latter is between the negative and the second plate or film, and so that the surfaces of the two plates are outside. The second plate is now exposed, through the negative and the linear plate, to parallel rays of light. The transparency thus obtained is developed, fixed, and washed as usual, and the negative is then removed by any convenient means. The transparency to which the linear plate is now adhering shows the picture in its natural colours. The claim is for a process for making transparent colour photographs from negatives taken through a linear plate by immovably fastening a light sensitive film to the linear plate of a negative, exposing the same, and then removing or destroying the negative so that the linear plate remains combined with the positive.—“B.J.” (Colour Supplement), Dec. 6, 1907, p. 94.

Brasseur Screen-Plate Process.—Further patents taken out by C. L. A. Brasseur are:—(1) For polychrome glass screens for use when copying from one screen-plate on to another (Eng. Pat. No. 4,932, 1907.—“B.J.” March 27, 1908, p. 242), and (2) for adjustable compensating filters of sector form for use on the lens. (Eng. Pat. No. 4,745, 1908.—“B.J.” July 3, 1908, p. 515).

Catalytic Methods of Screen-Plate Photography.—Carl Schinzel contributes to the “Chemiker-Zeitung” a lengthy paper of a suggestive nature, in which methods are described apparently with the intention of pointing out future possibilities in them.—“B.J.” (Colour Supplement), Aug. 7, 1908, p. 61.

Copies of Screen-plate Transparencies.—Dr. E. Stenger and F. Leiber, by copying from one Krayn screen-plate on to another, have

confirmed the conclusions of Dr. C. E. K. Mees as to the admixture with black or white which occurs when copying from one geometrical screen plate on to another ("B.J.A.," 1908, p. 572).—"Zeit fur Repro.," Aug. 1908, p. 114; "B.J." (Colour Supplement), Sept. 4, 1908, p. 69.

In a later paper the authors give the theoretical rules for the placing of several sources of light or the movement of one source when printing from one screen-plate on to another.—"Zeit. fur Repro.," Sept., 1908, p. 130; "B.J." (Colour Supplement), Oct. 2, 1908, p. 76.

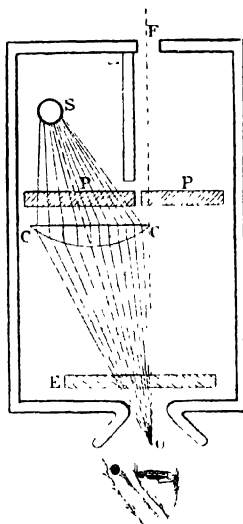
J. M. Child has patented a printing frame specially designed for the copying of screen-plate colour transparencies. Eng. Pat., No 10,802, 1908.—"B.J." Sept. 11, 1908, p. 702

The Lumière Autochrome Process.

Actinometers and Autochromes.—Alfred Watkins writes that his first experiments with autochromes, made on flowers and still-life indoors, were successfully timed by taking the speed of the plates as 1 on the Watkins' meter—that is to say, the exposure was the time taken by the paper to attain the standard tint. Later, outdoor exposures were found to need the speed being taken as 2, or in some cases as 3, otherwise the plates were over-exposed. As regards the suggestion that the remedy for this discrepancy would be an orthochromatic meter paper, Mr. Watkins points out that tests made by him in the past of colour-sensitised meter paper alongside the standard brand showed that the orthochromatic paper was not slower, and would be no better guide to the exposure of autochromes. On trying the use of a colour-filter over the actinometer it was found that the standard meter paper was relatively quicker under the autochrome screen indoors to the same condition outdoors than when uncovered. Thus, if a screen be used over the meter, both in and out, it increases the defect and does nothing to rectify it. Mr. Watkins attributes the discrepancy (1) to the difference between a print-out and a developed emulsion, and (2) to a breakdown of the general law that intensity and time are interchangeable as regards chemical light effect. There is evidently a difference in ratio between bright and feeble light of the autochrome plates and the meter paper.—"B.J." (Colour Supplement), Nov. 1, 1907, p. 82.

An Exposure Meter for Autochromes.—A. Peaucellier recommends a form of portable photometer by which to measure the maximum monochromatic intensity of the brightest part of the subject as a guide to exposure of the Autochrome plate. Theoretically, the measurements should be made through red, green, and blue-violet screens, but in practice one orange or red screen answers well. The meter consists of a box containing a small paraffin lamp adjustable to a constant height, a condenser, CC, which throws an image of the homogeneous parts of the flame on to the pupil of the observer's eye, the image being larger (that is, at least 6 mm. in diameter)

than the pupil. The orange screen is placed at E, and the instrument used by directing the aperture F to the brightest part of the object, and adjusting the graduated wedges PP until equal illumination is obtained. The apparatus has been found to work



well out of doors from noon to dusk, but indoors and under trees it has given exposures uniformly less than the correct.—"Photo-Revue," Feb. 16, 1908, p. 53; "B.J." (Colour Supplement), April 3, 1908, p. 27.

Light-filters for Screen-plate Exposures.—Dr. E. Wandersleb has patented the making of the yellow compensating filter (employed when taking screen-plate photographs) of such form that when placed in front of the lens it allows of the ordinary method of focussing remaining in use. Usually compensation as to focus takes place only when the filter is placed behind the lens (see "B.J.A.," 1908, p. 563). The filter is made in the form of a weak dispersive lens, which in conjunction with the camera lens increases the focal length of the latter a little—sufficiently to compensate for the backward displacement of the sensitive surface due to exposure through the glass of the plate.

The increase in the focal length of the objective incidental to the filter-lens should amount to about two-thirds of the thickness of the support, that is 1 mm. when this thickness is 1.5 mm. If the focal length of the lens proper be 150 mm. a negative focal length of the filter lens of 22.5 metres would just bring about this increase.

The same filter lens would also suffice for lenses of 145 mm. and of 155 mm. focal length, without the position of the image being so much displaced relatively to the sensitive surface as the casual differences in the thickness of the supports would amount to. In general, the greater the focal length of the objective the greater must the focal length of the filter lens be chosen.

The displacement of the image due to the influence of the filter lens is not independent of the distance of the object to be taken, but the variations in displacement for the ordinary distances at which photographs are usually taken, and which represent a high multiple of the focal length of the objective, are again smaller than the chance differences in the thickness of the supports. Eng. Pat. No. 23,738, 1907. "B.J.," Aug. 14, 1908, p. 625.

Sky and Foregrounds in Autochromes.—M. Personnaz has recorded some of the expedients used by him in graduating the exposure on an Autochrome plate so as to give as much as seven times the exposure to the foreground as to the sky. He carries with him a number of black cards with one edge cut to some irregular outline. When choosing the subject he looks into the lens from a point enough to one side not to obstruct the view, and inspects the inverted image of the scene reflected in the front lens. He then chooses the card most suited to the horizon line and holds it before the lens (almost touching the hood) whilst making a "time" shutter exposure, the card being kept gently moving to avoid a sharp dividing line. While the method is practicable with lens serving for plates as small as 9x12 cm., it cannot be used for smaller lenses, such as those of the Verascope and other pocket cameras. "Bull. Soc. Fr. Phot.," April 15, 1908, p. 179.—"B.J. (Colour Supplement), July 3, 1908, p. 53.

J. McIntosh, as the result of making a series of Autochrome pictures of the Thames from source to mouth, has found the Autochrome plate more rapid than when first issued. He places it at from 3 to 4 Watkins, and has also found that the irregularity of coating noticed in the first plates, and causing a dark band in the transparency, is now absent. For securing blue skies or white clouds in a landscape and at the same time rendering the foreground well, he finds it best to expose double the usual time and to develop for half the usual period. He uses the new Lumière developer (see above), and watches development at intervals by judicious use of the ordinary darkroom light.—"B.J. (Colour Supplement), September 4, 1908, p. 65.

Autochromes on Tour.—M. G. Courtellemont has recorded results of making some 1,300 pictures on Autochrome plates in the Near East. He developed whilst on tour. This he did every evening in the bedroom of the hotel, carrying the process only as far as two stages—namely, the development in the pyrogallic solution and the reversal of the image in the permanganate. He then put the plates aside until the next morning, when they were exposed to daylight and re-developed with diamidophenol. The intensification of the plates was postponed until he returned home. M. Courtelle-

mont is thus strongly of the opinion that Autochrome plates may be taken by the tourist with just the same amount of satisfaction as ordinary plates are at present, as regards results. His own results of satisfactory transparencies amount to 60 per cent. of the total 1,300 plates exposed.—"Photo Gazette," May 25, 1908, p. 130; "B.J." (Colour Supplement), June 5, 1908, p. 46.

M. Chabaseau finds that white card will do as well as black for backing-up the Autochrome plate in the camera. Though it does not reduce the time of exposure it is without action in the way of producing fog or halation.

Second development of the plate may be postponed for a considerable time without ill effects resulting from exposure of the plate in the meantime to moderate daylight, say the light from a clouded sky acting for half an hour.

When on tour it may be convenient to use ammonium carbonate, 8 or 9 gms., in place of 10 c.c.s. liquor ammonia of 20° Beaumé.—"Bull. Soc. Fr. Phot.," Sept. 1, 1908, p. 349; "B.J." (Colour Supplement), Oct. 2, 1908, p. 75.

Control During Development—MM. Lumière have recommended modified developing formulæ for use with Autochrome plates. The latter are handled in a faint green light, special filters for this purpose being made by the Lumière firm under the name of "Virida." The principle of the new method is to add at the outset only about one-quarter of the ammonia. The time of appearance of the image is noted, and further addition of ammonia then made in accordance with this observation, and development continued for a period which is also determined by the time of the first appearance.

• DEVELOPING SOLUTIONS

AA.—Water	100 c.c.s
Bisulphite of soda liquid (commercial)	2 drops
Pyrogallie acid	3 gms.
Potass. bromide	3 gms.
BB.—Water	85 c.c.s.
Anhydrous soda sulphite	10 gms.
Ammonia .920 (22 deg. Beaumé)	15 c.c.s.

For use, dilute to $\frac{1}{4}$ strength—i.e., 50 cc. solution BB, 150 c.c. water.

For a plate 13 by 18 cm. pour into the dish—

Water	80 c.c.s.
Solution AA	10 c.c.s.
Solution BB diluted to $\frac{1}{4}$ strength	10 c.c.s.

Temperature 60 deg. F

and put in a small graduated measure

45 c.c.s. of solution BB ($\frac{1}{4}$ strength)

ready for addition, if necessary, wholly or in part, to the developing bath during development.

When the plate is in the dish, count the number of seconds elapsing between the plate entering the dish and the appearance of the first contours of the image, disregarding the sky if a landscape.

It is unnecessary to come near to the light under 20 seconds at least, for whatever may be the degree of over-exposure of the image, the first outlines never appear under 22 seconds.

As soon as the image has appeared, keep the plate from the light by turning your back to the lantern, and, if needed, add to the developer the remainder of solution BB kept in reserve in the small graduated measure.

Proportionately to the time of appearance of the image, varying quantities of the reserve solution BB from the graduated measure are added. The time of development may be varied by the quantity of BB added. The quantities of solution BB and the different times of development corresponding to the time of appearance of the image are indicated in the following table:—

Time of appearance of first outlines of image, disregarding sky.	Quantity of solution BB diluted to 1 to add after first appearance of image.	Total duration of development, including time of appearance of image	
Seconds	Cubic Centimetres.	Minutes.	Seconds.
22 to 24	nil	2	—
25 to 27	2	2	15
28 to 30	8	2	30
31 to 35	15	2	30
36 to 41	20	2	30
42 to 48	25	2	30
49 to 55	30	2	45
56 to 64	35	3	—
65 to 75	40	4	—
Above 75	45	5	—

This method of development, which has been used experimentally on a large number of plates, has given excellent results, particularly with over-exposure—"B.J." (Colour Supplement), June 5, 1908, p. 44.

Time Development of Autochromes.—Alfred Watkins writes of the satisfactory result obtainable by exact exposure of the Autochrome plate followed by time development adjusted for varying temperature of the solutions. (See under "Time Development") In other respects he follows the Lumière operations of reversal, second development, and clearing, but finds that intensification may be dispensed with—"Phot.," Sept 8, 1900, p. 365; B.J. (Colour Supplement), Oct. 2, 1908, p. 73.

Timing Autochrome Development.—M. L. Gimpel, in working according to the new method of Lumière (see above) recommends the use of a phonograph in the dark room as a means of counting seconds whilst the Autochrome is being closely watched. The phonograph is first fitted with an unused cylinder and registering diaphragm, and caused to register as follows:—

"Development of Autochrome plates. Attention" (pausing here a second). "One . . . two . . . three" . . . up to 240, beyond which point the size of the phonograph cylinder would not go.

Everything being in readiness for development, the dark-slide is unloaded, the plate is held with its back to the dark-room lamp, and the phonograph released. Whilst the first words are being

reproduced by it the plate is held ready for insertion in the developer, and at the conclusion of the last syllable of the word "Attention," is immersed. It is then quite an easy matter to give all attention to the appearance of the image whilst the phonograph is audibly counting the seconds. Those who may wish to adopt this method should make a note of the necessity of adjusting the speed of the phonograph after the record has been made. The resistance offered by the recording diaphragm slows down the mechanism to a quite appreciable extent, and the time of one second noted after the record has been made will often be found to be appreciably less if the adjustment is omitted. However, this can be easily done, and the timing will not vary a second in four or five minutes.—"Bull. Soc. Fr. Phot.," August 1, 1908, p. 317; "B.J." (Colour Supplement), August 7, 1908, p. 61.

Acid Amidol for Autochrome Developer.—C. Simmen recommends the immersion of the Autochrome plate first in a solution of commercial sodium bisulphite, which greatly reduces the colour sensitiveness. A better method, however, is to use amidol in acid solution, which greatly reduces the general sensitiveness, and allows of the Autochrome plate being developed in a light which would be used for bromide paper [Compare the contrary experience of Dr. E. Stenger. See under "Negative Processes -Orthochromatics."—Ed., "B.J.A."]

Sodium bisulphite (commercial solution)	4 parts
Sodium sulphite (anhydrous)	3 parts
Potassium bromide, 10 per cent. sol	2 parts
Amidol	1 part
Water	100 parts

Development takes twenty minutes at 60 deg. Fahr. for correct exposure, and from two minutes to one hour for exposures varying between a quarter and fifteen times.

Autochrome plates will actually stand an hour's development, but it is preferable, if the image is slow in coming up, to immerse the plate in a strong developer, in which it will rapidly appear.

Development is always easy to follow. The image always appears more intense than it actually is, or, rather, the silver bromide not reduced and destined to give the positive after reversal, always remains in greater quantities than one would believe, from its transparency. As it is these small quantities of silver bromide which give to the finished picture the most delicate half-tones, it is very important to preserve them with all their value. After a little experience a green light is much more serviceable than a red one.—"Phot. des Couleurs," Jan., 1908, p. 1; "B.J." Colour Supp., Feb. 7, 1908, p. 9.

A committee of the French Photographic Society reports that whilst acid diamidophenol gives good results with Autochromes, the plates are less brilliant than when the Lumière *pro* developer was used, and the latter is on the whole to be preferred—"Bull. Soc. Fr. Phot.," April 1, 1908, p. 159.

H. G. Drake-Brockman records the satisfactory result of the action of a preliminary bath of 3 per cent. solution potass metabisulphite used for 30 seconds on the Autochrome plate, after which treatment the plate was washed in running water for one minute and developed in a bright orange light formed by two thicknesses of canary medium in a lamp fitted with a No. 1 Bray burner. The developer used was pyro-ammonia.—“B.J.” (Colour Supplement), Oct. 2, 1908, p. 80.

Autochrome Developers.—A. J. Woolway recommends rodinal as a developer used of strength 1 to 12 of water for a time of 6 mins. at 60° F.—“Phot.,” Nov. 26, 1907, p. 450.

W. E. Clifton recommends a two-solution method of finishing Autochromes. The first development is done in rodinal 1 in 10, the C reversing solution applied for 2 mins. only and the plate then rinsed and dried.—“B.J.,” Feb. 14, 1908, p. 130. [We have seen several very good Autochromes made in this way by the above writer.—Ed., “B.J.A.”]

H. D’Arcy Power advises the following procedure:—Develop with 1 in 8 rodinal and immerse in reversing (C) bath, face downwards. This can be done by using a tray just large enough for the plate and putting a piece of glass rod at one end. This device prevents particles from the reversing solution settling on the plate. Keep all solutions below 50° F., and plates will not frill.—“Cam. Craft,” June, 1908, p. 215.

Dark-Room Light.—Arthur Payne recommends the following fluid light-filter for the dark-room lamp for the development of Autochromes, using the light at the lowest possible point consistent with being able to see:—

Acid green	2 parts
Naphthol green	2 parts
Tartrazine	15 parts
Water (dist.)	300 parts

Dilute this solution with 25 parts of water, and use in a glass cell 1 inch thick, with the addition of a sheet of ground glass.—“B.J.,” Oct. 25, 1907, p. 803.

Sodium Hydrosulphite in Autochrome Development.—M. Georges Le Roy advises the use of a weak bath of hyposulphite of soda (not to be confused with hyposulphite or common hypo) as a bath to be used for the removal of its red sensitiveness from the exposed autochrome plate. The plate, after this treatment, is washed for a short time and then developed, with no more precaution as regards the illumination of the dark-room than would be taken in the case of an ordinary plate. Hydrosulphite is a compound which is so unstable that it must be prepared at the time of use by the action of zinc filings or dust on concentrated sodium bi-sulphite solution, or filings of amalgamated aluminium may be used for preference. But, instead of going to this trouble, advantage may be taken of the compound hydrosulphites prepared in Germany for the dyeing industry. These contain dry hydrosulphite, or consist of this latter compound in conjunction with formic aldehyde (formaline). These latter are issued under such names as “hydralite,” “rongalite,”

and "decroline." A 10 per cent. solution is employed.—"Bull. Soc. Fr. Phot.," June 15, 1908, p. 258; "B.J." (Colour Supplement), July 3, 1908, p. 53.

Reversing Autochromes.—As suggested by M. Gravier, it is better to use the reversing solution of permanganate and sulphuric acid freshly mixed. The mixture, after long keeping, dissolves the silver image, but does not then act so cleanly, but deposits, when stale, a brown scum over the image. Moreover, specks are liable to form which is not the case with a freshly-mixed solution, and therefore the practice of keeping the permanganate and sulphuric acid in separate double strength solutions and mixing them before use is advisable.—"B.J.," Nov. 8, 1907, p. 839.

Persulphate Reversing Solution.—G. E. R. Rawlins recommends a solution of ammonium persulphate of 5 to 10 per cent., in preference to the permanganate C solution of the Lumière instructions. He uses two baths in succession, giving the plate five minutes in each.—"B.J." Colour Supplement, June 5, 1908, p. 43. [The black specks complained of by the writer as the result of using the permanganate reversing solution may be avoided by mixing the permanganate and acid at the time of use, for which purpose they may be kept as separate solutions.—Ed., "B.J.A."]

General Methods.—E. J. Steichen recommends working with a Wratten dark-room green safe-light for developing plates by inspection. As regards exposure, he takes the plate as f/11 in speed on the Wynne meter. This for outdoor work; indoors he gives exposures of forty times that required by Kodak film in summer; in autumn and winter sixty to eighty times. He comments on the apparent alteration in colours in lights of different intensity, a very weak light tending towards blueness, which tendency is further exaggerated on the Autochrome plate. He suggests the use of other colour filters (formulae not given) to correct for this.

A lens slightly uncorrected for spherical aberration, but free from chromatic aberration, was found to give most satisfactory results, producing massing of the colours and luminosity in the results. The "Smith" lens is such a one.

Mr. Steichen develops in the first instance with Rodinal of strength one in six to one in twelve, rinses under the tap, and places in the acid permanganate for two minutes to reverse. The plate is then again rinsed, put back into the original developer until blackened, then washed under the tap for a minute, dried and varnished.

No fixing is done, there being nothing fixable, unless the acid silver intensifier is used.

A plate which is slightly under exposed and then developed in Rodinal, 1:6, up to the point of reversal will give a brilliant, rich image, with stronger blacks than an image developed in a weaker developer to the same point. A plate a trifle over-exposed and developed about two minutes in 1:10 solution gives a beautiful soft positive full of modelling and colour, even in the darks, and devoid of any very strong lights. This method is particularly applicable in developing plates of subjects with a very great range of

tone and landscapes in crude, garish sunlight. A plate of this kind^o can be made richer in colour, still keeping its beautiful gradation, by intensification—in fact, a thin, greyish-looking plate can be built up to fiery effects of colour, to the point of exaggeration. With some emulsions it is found that the over-development of under-exposure gave very garish colour contrasts, between warm and cold tones, which can be very useful in certain instances. A figure photographed in the open air towards sunset with half the normal exposure and forced development; 1 : 6 Rodinal, to the reversal point, gave brilliant orange flesh-tones and intense pure blue shadows; the whole as unlike in colour to a plate made at the same time, with normal exposure and development, as a Monet is to a Corot, whereas in detail and strength they were really alike. The same experiment with pyro developer gave still greater contrast. Autochromes intended for lantern slides should be both fully exposed and developed to get a gradation all over.

As regards intensification, Steichen omits it, if exposure and development have been correct, attributing the garish, false colours seen in many plates to too much intensification. However, the simplest method of Steichen's building up the image is by means of the Agfa intensifier, 1 to 15, used for about a minute. It can be applied locally with a soft camel's hair brush. Also, the mercuric iodide intensifier gives very rich dark effects, slightly changing the general tone, and making it warmer and more golden. A good point about the iodide intensifier is that its darks are never opaque. Its action can be further increased by application of mercury chloride solution followed by a developer; or, if great density is needed, by ammonia, although this latter makes the emulsion brittle and liable to crack. The acid silver intensifier recommended by the Lumières is the only one advisable for lantern slides.

For reduction the weak acid permanganate bath, $\frac{1}{2}$ oz. in 16 ozs. of water, works well, but better for flat transparencies is the Farmer's reducer of hypo-ferricyanide. Either must be used cautiously, or the delicate colours suffer; but under-exposed plates, which otherwise would be useless, can sometimes be saved by clearing and intensifying.

Black spots in the plates can be removed by applying the Farmer reducer with a fine brush, and the same re-agent can be used for other retouching work.

In using the autochrome plates by artificial light (flashlight) Steichen obtains a brilliant monochrome orange-coloured effect somewhat similar to that obtained by painters of lamplight effects by using the Lumière colour filter. Working in this way, flashlight and daylight may be used in combination; the "Agfa" powder was found best, and about ten times the quantity required by an ordinary plate employed. For effects in correct colours a filter either of flavine, chrysophenine, or a filter yellow K gives the best results. Steichen suggests the marketing of a suitable panchromatic collodion emulsion which could be used for the re-coating of spoilt screen-plates.—"Camera Work," April, 1908: "B.J.," April 17, 1908, p. 300.

- *Three-Solution Treatment of Autochromes.*—F. Martin Duncan, in giving a demonstration of M. Gravier's method of treating Autochromes, supplied the following formulæ, stating that, working by artificial light, the process did not (he believed) give a true colour rendering. Developing solution :—

A. Pyro	3 gms.
Potass. metabisulphite	2 gms.
Water	100 c.c.s.
B. Potass. bromide	3 gms.
Ammonia, '880	60 c.c.s.
Distilled water	85 c.c.s.

Eight c.c.s. each of A and B are added to 80 c.c.s. of water to make the developer, which is used for two and a-half minutes, and the plate then immersed for an instant in a solution of sulphuric acid (1 part in 200 of water), and then placed in an acid permanganate bath, made by mixing 8 c.c.s. each of C 1 and C 2 with 80 c.c.s. of water :—

C 1. Potass. permanganate	2 gms.
Water	100 c.c.s.
C 2. Sulphuric acid	10 c.c.s.
Water	100 c.c.s.

The bath is used for four minutes, and the plate is then placed for five to fifteen minutes in—

E. Sodium bisulphite solution	10 c.c.s.
Water	500 c.c.s.

after which it is washed for a minute, dried quickly, and varnished. —“*Phot. Journ.*,” April, 1908, p. 172.

Control Methods for Autochromes.—M. F. Monpillard gives the following hint as to the reduction in intensity of an autochrome which, sometimes takes place in the fixing bath. It is found that if, when the plate comes out of the fixing bath, part shows a dichroic veil, the plate should be well washed to remove all trace of bisulphite and placed again in the bath E. If the bisulphite be left in the film there will be formed, in the presence of the permanganate, a small quantity of sulphuric acid, which, combining with the silver of the image, will form a subsalt soluble in the fixing bath, and will thus lead to a general reduction of the image, a cause of failure which has been experienced by many autochrome workers without perhaps knowing the reason.

As an additional aid to securing contrast, the writer recommends the mercury intensifier in which the autochrome is bleached in a solution of mercury bichloride and potassium bromide of a strength one-quarter or one-fifth that usually employed for negatives. It is afterwards well washed in running water and darkened in a mixture of potassium cyanide and silver nitrate. [This is the Monckhoven intensifier, the formula for which will be found under “*Negative Intensifiers*” on a later pager in the Formulæ section.—Ed., “*B.J.A.*”]

In the case of an autochrome which, on removal from the reversing C bath, shows a veil of silver bromide and general saddened colours, indicating much over-exposure, too much ammonia, or over-

development, the use of a very weak hypo solution at this stage will improve the result by removing this deposit of silver bromide before the second development. The solution to be used is :—

Hypo solution (20 p.c.) 1 to 2 c.c.s. 15 to 30 mins.

Water 100 c.c.s. 3½ ozs.

On taking the plate out of solution C, and giving it thorough washing (placing it in alum solution if necessary), it is immersed in this bath. Great care is taken to watch the plate by transmitted light, using plenty of illumination, preferably a yellow or green colour. Occasionally the plate should be examined by white diffused light, but as little as possible, in order that the silver bromide may not be so much exposed as to affect its reduction in the D solution. In this weak hypo bath the whites and all the colours of the plate lighten a little. The light half-tones should be carefully watched, as they may be eaten away and destroyed by too long an action. When the result is obtained the usual process is followed out. As a rule, a plate treated in this way requires to be strongly intensified, but the relative values of the tones are retained. This method is preferable to the use of a solution of iodine followed by the hypo bath. In fact, it is then impossible to control the action of the first solution, whilst, by using the hypo bath after reversal, we can follow this action step by step and assist it at the right moment. It may be added that the experiments which have been tried with a view to reducing the density of the image on the autochrome plate after the second development have led to experiments with persulphate, Farmer's reducer, and ceric sulphate, none of which have given satisfaction. Recourse was then had to a weak solution of acid permanganate, or to hypo solution, and plates which appeared to be hopeless were thus saved.—"Bull. Soc. Fr. Phot.," June 1, 1908, p. 231; "B.J." (Colour Supplement), July 3, 1908, p. 49.

Sulphide Toning for Autochromes.—M. Paul Torchon recommends the use of an alum bath, followed by sulphide solution, in place of redevelopment and intensification. He thus has only the four operations :—

Development,

Reversal,

Aluming,

Sulphiding.

After reversal the plate is placed in :—

Alum 2 gms. 30 grs.

Bisulphite solution 5 c.c.s. 80 minims

Water 200 c.c.s. 7 ozs.

The alum hardens the gelatine solution and removes the risk of frilling; the bisulphite reduces all the permanganate left in the plate after reversal. After two minutes in this bath the plate is transparent and the image pure white.

The sulphiding bath is made up as follows :—

Ammonium sulphide 5 c.c.s. 80 minims

Water 100 c.c.s. 7 ozs.

After a short wash the plate is placed in this solution, where the image is converted into silver sulphide and assumes an intense black colour, the picture making its appearance in its natural colours.

The special object of adding the bisulphite to the alum bath is

to make sure that every trace of permanganate from the reversing solution is destroyed, otherwise the formation of manganese sulphide in the film on treatment with the sulphide solution would inevitably lead to trouble.

There is no need, when adopting the foregoing process, to intensify the plate; the colours are brilliant, and retain the values present in the subject.

One great advantage of the process is that there is no need to fix the plate in hypo, all the silver in the film having been converted into sulphide.—“Photo-Revue,” July 26, 1908, p. 30; “B.J.” (Colour Supplement), August 7, 1908, p. 60.

Formaline as a Preventive of Frilling.—Alfred Stieglitz records the satisfactory effect of treating the autochrome plate for one minute with a 3 per cent. solution of formaline before development, giving a short rinse between. The formaline was used to counteract the effect of warm developers and other solutions which had to be used at 75 deg. F. In no case was the brilliancy of the colour affected, though the writer does not definitely decide whether the treatment with formaline should be done before or after the first development.—“Camera Work,” July, 1908, p. 49; “B.J.” (Colour Supplement), July 3, 1908, p. 53.

Autochrome Varnishes.—E. Valenta, in place of the dammar varnish first recommended for autochromes, prefers the following:—

Carbon tetrachloride	100 c.c.s.
Gum dammar	2 gms.
Mahilla copal (powdered)	5 gms.

Heat to boiling point for a few minutes, and then filter hot.—“Phot. Korr.,” Jan, 1908, p. 24; “B.J.” (Colour Supplement), March 6, 1908, p. 20.

G. A. Le Roy has recommended a formula for a varnish preferable to that of gum dammar in benzole on account of its lesser degree of inflammability. He employs carbon tetrachloride as the solvent, and dissolves it in a mixture of dammar and mastic as follows:—

Resin dammar	10 gms.
Mastic (tears)	10 gms.
Carbon tetrachloride	150 gms.

The three ingredients are best warmed moderately together in one bottle, and the solution filtered through paper into another.—“Bull. Soc. Fr. Phot.,” Nov. 1, 1907, p. 472; “B.J.” (Colour Supplement), Feb. 7, 1908, p. 13.

Autochromes of Bluish Tint.—F. Dillaye, in a report to the Gaumont Company, ascribes the blueness observable in some autochromes (1) to under-exposure, (2) to leakage of white light, and (3) to certain conditions of the lighting of the subject. Snow scenes and seascapes, particularly when lighted from a sky in which blue largely predominates, would seem to require a light-filter other than that usually employed for the autochrome plates. Esculine as a light-filter was not satisfactory, as it cut out the violet completely, and the blue remained too crude. Better was a supplementary screen dyed with picric acid. The writer suggests the use of a

set of screens increasing the exposure from one and a quarter to two times, the deepest being suitable for the rendering of snow-covered mountains or glaciers.—“Phot.,” March 17, 1908, p. 224.

Remedying Colour Effects in Autochrome Plates.—G. A. Le Roy, commenting on the tendency of autochrome transparencies to be too bluish when under-exposed, and too reddish when over-exposed, prescribes a remedy for these defects in the shape of weak staining baths capable of imparting to the plate a slight colouration, the complementary of that which it possesses. Thus a bluish plate is immersed for a few minutes in a weak bath of yellow, such as Poirier's Orange II. Such a bath must be of the requisite dilution, and must not be allowed to act too long, or the result will be disastrous.—“Bull. Soc. Fr. Phot.,” Nov., 1907, p. 473; “B.J.” (Colour Supplement), Feb. 7, 1908, p. 11.

Measurements of the Autochrome Plate.—R. J. Wallace has published in “Popular Astronomy,” Feb., 1908, his measurements of the autochrome plate, chief among which are the following:—The blue colour is the most soluble, next the red, whilst the green grains retain colour for a long time under treatment with water of 90° C. In cold water the green grains appear to be the first to give up their colour, next the red, while the blue appears to persist. In alcohol the green colour is slowly discharged and the filter film comes away from the glass. In weak ammonia the colour slowly goes in the order of red, green, and blue. In acid permanganate the colours are all equally, but slowly, discharged. The emulsion film is found to be .00015 inch, as compared with .0012 inch, the thickness of the film of the Seed “27” plate. The film is not entirely soluble in hot water, nor in a mixture of ether and alcohol, and would appear to be a combination of gelatine and collodion. The silver grain is exceptionally fine for a fast plate. The unscreened emulsion shows a heavy drop in sensitiveness in the blue-green, and a second from $\lambda 5,890$ (D) to $\lambda 6,200$. The sensitiveness ends with normal exposure at about $\lambda 6,500$. The filter issued by the Lumières is such as cannot easily be improved upon for use with the emulsion. As regards speed of the plate screened by both the filter-film and the compensation filter, the author finds it to be 1/50th of the Seed “27.”—“B.J.” (Colour Supplement), March 6, 1908, p. 21.

Sections of the Autochrome Plate.—Dr. W. Scheffer, as the result of photo-micrographic examination of the autochrome plate, refers to the occurrence, to some extent, of wrong colouring due to paralax, which may take place when a transparency is viewed at an angle of about 45°. No regular reversal of colours can take place, as in geometrically-ruled plates, and, as a matter of fact, wrong colouring due to angular observation is rarely seen in the autochrome plate, owing to the irregular surface of the filter-grain. The same property is responsible for the results obtained in copying from one autochrome on to another, the scattering of light produced by the surface doing much to counteract the superimposition of one grain (in the original) by another of a different colour (in the sensitive autochrome plate employed).—“Phot. Rund.,” Feb., 1908, p. 52; “B.J.” (Colour Supplement), April 3, 1908, p. 25.

• *H. and D. Number of the Autochrome Plate.*—E. J. Wall, from measurements of the autochrome emulsion, in comparison with an ordinary plate of standardised speed, finds that the H. and D. number is 2.—“B.J.” (Colour Supplement), July 3, 1908, p. 56.

Diagrams of the Autochrome-Process.—A set of diagrams suitable for copying in the camera and colouring are reproduced in the “B.J.” (Colour Supplement), July 3, 1908, p. 55, from designs by E. A. Salt.

Autochromes from a Set of Three-Colour Negatives.—Dr. F. Stenger has given directions for the making of a single autochrome from a set of the three-colour-sensation negatives. He provides the negatives with register frames and the autochrome plate with a similar frame, exposure being given through the filter-film of the autochrome plate in three separate times, which must be adjusted according to the ratios of the three-colour filters, which are placed between the light source and the printing frame. The exposures also vary according to the light source employed.—“Atelier,” Feb., 1908, p. 18; “B.J.” (Colour Supplement), April 3, 1908, p. 30.

Transformation and Stereoscopic Pictures on the Autochrome Plate.—Jan Szczepanik remarks upon the practicability of using the Autochrome plate for the making of a single transparency, in which, according to the use of a particular filter, three different pictures can be seen. The process depends on the use of a red, green, and blue filter, in each case corresponding to the colour of the starch grains, and used at the time of making the exposure. Thus the use of a red filter—the neutral red of Cassella can be used—corresponds with the red starch grain filter of the Autochrome plate, and therefore when it is used on the lens in making an exposure an image is produced only on the parts of the film behind the red starch grains. A second exposure may be similarly made on the same plate, using a filter of naphthol green, and, finally, the third exposure, again on the same plate, can be made with a filter of Victoria blue or cresyl blue. After development and reversal the three pictures present the appearance of having been printed in the respective colours upon one another on the same plate, so that no distinct image is recognisable, but when each is examined through its correct filter the picture becomes clearly visible against a black background. The Autochrome plates can also be used for the production of a stereoscopic pair of pictures each the full size of the single plate. This is done by taking the right hand picture through a violet filter, such as the crystal-violet of Hoechst. This gives an image in the part of the film behind the red and blue starch grains. The picture for the left eye is then taken through a yellow screen-filter, and, after development and reversal, the composite picture is observed through a pair of spectacles, of which the glass for the right eye is of the colour for the right-hand picture—namely, violet—and the other yellow-green. The stereoscopic effect of the print is thus obtained in accordance with the well-known stereoscopic principles.—“Phot. Ind.,” July 22, 1908, p. 827; “B.J.,” (Colour Supplement), Oct. 2, 1908, p. 80.

Stripping the Autochrome Film.—Dr. W. Scheffer finds that for removing the composite autochrome film of starch grains and emulsion from the glass (e.g., for section cutting) the best solvent is xylol, which dissolves the adhesive employed to secure the film to the glass, but does not affect the other constituents. The film has to soak in the liquid for several days, as the latter can only obtain access from the edges.—“Phot. Rund,” Sept. 8, 1908, p. 103.

COPIES OF AUTOCHROMES.

Pinatype Prints from Autochromes.—L. Didier has given details of the application of the pinatype process to the reproduction of autochrome pictures. The autochrome is best prepared as a negative (unreversed). From it are separately made three positive transparencies representing the three-colour-sensations in the negative. A filter of green, red, or blue-violet is used in thus printing from the autochrome, the operation being done in the camera, or, quite practically, in the printing frame. The transparencies are themselves used as the pinatype print-plates, and it is found that the scattering of light from the grains of the image is sufficient to prevent the degradation of the print. The positive transparencies (print-plates) should be fairly strong in contrast, but with good gradation and perfectly clear whites.—“Phot. des Couleurs,” March, 1908, p. 65; “B.J.” (Colour Supplement), May 1, 1908, p. 35.

Prints from Autochromes by Means of the Leuco Bases.—E. Stenger and F. Leiber, in discussing the possibility of preparing a print-out paper which at one exposure underneath a screen-plate colour negative should give a positive in colours, incline to the view that the leuco compounds of dyes will permit of this result being obtained. The colours formed from the leuco bases are brilliant and transparent. For reproduction of screen-plate negatives the paper would have to be coated with leuco bases which give the colours bluish-red, yellow, and blue-green. The authors are unable to decide whether the leuco bases can be mixed before applying to the paper, or whether, for example, starch grains may be impregnated separately with the bases and a mixture applied to the paper. Inequalities in the sensitiveness of the bases can no doubt be overcome by covering the printing frame during half of the time of printing with a colour filter faintly stained with a dye complementary to the colour.—“B.J.” (Colour Supplement), May 1, 1908, p. 34.

Duplicates of Autochromes.—C. Welborne Piper’s paper in “B.J.” (Colour Supplement), Nov. 1, 1907, was included in last year’s Almanac (“B.J.A.,” 1908, p. 709).

Ortho’ Prints from Autochrome Plates.—See under “Orthochromatics.”

THE WARNER-POWRIE PROCESS.

Warner-Powrie Process.—A modified form of screen-plate has been made by Mr. Powrie of fineness which renders the “structure” of the pictures almost as continuous-tone. The filter plates,

like those of 600 lines per inch already exhibited, are made from a 200-line grating or model, but by a modified method which gives a series of squares of two colours between each line, and moreover is carried out without registration. The result of the process is a screen of such fineness that it will stand magnification to about 150 diameters for lantern projection purposes, obviously more than sufficient to retain fine details. Moreover, the colours, to judge from the specimen, are brighter and more transparent even than the previous make of screen-plate. The process of manufacture, which secures a distribution of the colour elements without gaps or overlap, and this without registration in printing, may be carried out on the machine installed by Mr. Powrie in London for the linear-ruled plates (which may still have advantages for certain specific purposes) at an increased output.—“B.J.” (Colour Supplement), Sept. 4, 1908, p. 72.

THREE-COLOUR CARBON PRINTS.

Cementing Three-Colour Carbon Prints.—A modified method of assembling the three components in the making of a carbon trichrome on Rotary three-colour pigment films is as follows:—

Assuming that the yellow print is first transferred, the yellow print is softened for about a quarter of an hour in water at 80° to 90° F. This done the three-colour transfer paper is placed for about five minutes in water at 65° to 80° F., and the pigment film brought under water in contact with the transfer paper, film to film. The two are drawn out of the water together and laid, paper side under, on a smooth surface covered with one or two thicknesses of filter paper. A piece of filter paper—or, better still, a thin film of celluloid—is laid on the top and rubbed over with a soft towel. The print, thus united with the transfer paper, is put between two glass plates under slight pressure for a quarter of an hour, the pressure being conveniently applied with a few clips. At the end of this time the print and transfer paper are hung up together in the air and allowed to dry at the ordinary temperature. The yellow pigment film will stand a decent amount of pressure, and therefore the above described process can be carried out with the aid of a press, or with an ordinary frame fitted with strong springs. Such, however, should not be used in the case of the red and blue films. It is inadvisable to hasten drying by a greater heat than 70° F., as the gelatine film then dries too quickly, and the paper, on subsequently soaking in water, does not expand to the full. Moreover, the separating film is injured by too warm drying and thus obstructs the stripping of the celluloid; it is best, therefore, to dry at a moderate temperature with the aid of a ventilator.

After drying of the yellow print the celluloid support is removed, the picture rubbed over with a tuft of cotton wool moistened with benzole, and the transfer of the blue film then proceeded with in a somewhat similar manner. This pigment film should also be allowed to rest for a quarter of an hour in water of from 80° to 90° F., whilst

the mounted yellow print is laid in water at 65° to 70° until it has completely expanded. The blue and yellow pigment images are then brought together in contact in the gelatine solution.

The process is so adjusted that after the softening of the yellow paper print this latter, with the blue pigment film, is hardened for a few minutes in a 3 per cent. formaline solution. On removal from this solution the prints are allowed to drain, but, without being rinsed, are laid near each other on a thick piece of mirror glass, which has been previously warmed in water of about 110° F. The previous warming of the glass is an important part of the manipulation, as otherwise the cementing gelatine cools too quickly, and its adhesion is thus upset, causing a subsequent separation of the component films. For these reasons the cementing process should be done in a well-warmed room. Both prints are then coated, with exclusion of air bubbles, with a 3 to 4 per cent. solution of gelatine (soft emulsion gelatine), at 115° F., after which the blue pigment picture is, after the removal of any remaining air bubbles, taken up and quickly laid down on the yellow print. The whole is then covered with a large piece of celluloid and gone over quite lightly with the hand or with a rubber squeegee in order to remove excess of gelatine solution. If any air bubbles should be imprisoned between the two pictures they should be driven out by lightly rubbing with the point of the finger on the edges of the prints. If the squeegeeing is done too vigorously, too much gelatine will be expelled, and the prints will be sufficiently starved of adhesive to adhere badly. The blue print is now registered by hand, and left under pressure between two glasses for a quarter of an hour. After the gelatine has set the combined print is taken from the glass plate and pinned up to dry. After drying, which should not be done with the assistance of immoderate heat, the celluloid support is stripped off from the now greenish-looking print, and the surface, as before, gone over with cotton wool moistened with benzole. The mounting of the red print is done in exactly the same way.—"B.J." (*Colour Supplement*), May 1, 1908, p. 37.

Three-Colour Transparencies.—F. Leiver recommends a method of printing from the set of three-colour negatives in which the yellow image is formed of lead chromate, the blue image of Prussian blue, whilst the red image is produced by dyeing a film of bichromated gelatine printed from the green-sensation negative. The following solutions, which keep well, are required for the process:—

To be kept in a brown bottle.

Solution I.

Potass. ferricyanide	8 parts.
Distilled water	100 parts.

Solution II.

Lead nitrate	8 parts.
Distilled water	100 parts.

Solution III.

Ferric ammonium citrate (green)	25 parts.
Distilled water	100 parts.

Solution IV.

Potass. bichromate	2.5 parts.
Water	100 parts.

For the yellow image a print of lead chromate (chrome yellow) formed from a silver image is employed in accordance with the method of Professor Namias, published in Eder's Jahrbuch, 1906, page 26. For this purpose the positive transparency from the blue-filter negative is placed as soon as made, or after thoroughly wetting if it has been made some time, in the following bath which should be filtered if it becomes turbid:—

Solution I. 50 c.c.s.

Solution II. 5½ c.c.s.

Acetic acid A few drops.

The film should not contain the slightest trace of hypo, otherwise spots will be formed. The image should bleach out white, and then appear intensified to a notable extent. For this reason the transparency should not be developed too strongly. When the bleaching action is seen to have penetrated through the entire film, as can be easily seen by looking at the back of the glass, the plate is then washed until all trace of yellow stain has disappeared. It is to be borne in mind that a weak yellow stain cannot be recognised by artificial light, and, therefore, if daylight is not available it is well to wash for longer than usual. An hour's washing will do no harm.

The white image has now to be converted into the yellow chromate, for which purpose it is placed for a few seconds in the following bath:—

Solution IV. 1 part.

Water 1 part.

It is again carefully washed in running water until all yellow stain has disappeared from the high-lights. In order to render the image more transparent it is lastly given a coating of negative varnish.

The blue image is composed of a Prussian blue print prepared in the usual way. Films which have become fogged and have not been developed may be fixed out and dried after thorough washing. The whole manipulation may be done by artificial light or in subdued daylight.

A mixture is made in equal parts of Solutions I. and III., filtered, and the films brought separately into it at the rate of one a minute, keeping the solution moving and avoiding air bubbles adhering to the film. The bathed films are then transferred into clean water, and hung up in the dark to dry. They remain in a usable condition for a few days. When dry they are printed under the red-filter negative, best in direct sunlight. It should be remembered that on placing them afterwards in water for development the blue colour goes back to a certain extent. They are washed in the water until no further yellow stain is visible. A slight improvement in them may be made by adding 1 or 2 per cent. of pure hydrochloric acid to the last wash water. If the image is too dense, washing for several hours in water will effect a certain

amount of reduction, but all other reducing methods, such as those with soda and potash, must be avoided, as the spots and stains incidental to them would ruin any print intended for a three-colour positive.

The blue image may, of course, be made by converting a silver (bromide) or lantern-plate image into Berlin blue, and this process is quite practicable.

For the preparation of the new image a strong but not too "contrasty" transparency is made from the green negative. Glass plates coated with the gelatine film, such as undeveloped, fixed, and washed dry plates, are laid in the dry state by lamplight or subdued daylight in Solution IV. They remain therein for two minutes, being carefully rocked the while, and air bubbles are removed with a soft brush. The plates thus prepared can be kept for at least fourteen days. They are printed in a very bright light, best in sunlight as above described, for the blue transparency. As it is difficult to judge of the progress of printing it is well to use an actinometer fitted with the ordinary collodion paper. The printing is done according to the density of the transparency, from six to ten degrees Vogel, and the bichromated plate is then washed for half an hour in running water and set to dry. In the moist state a distinct relief is visible. The dry plates are then immersed in a suitable red dye solution, which in proportion to the height of the relief is taken up by the film to greater or less extent, and gives a positive transparency corresponding to the red image. The progress of the dyeing can be easily observed by removing the plate. This red plate, after a brief rinse, can be laid for a moment in contact with the two other components of the three-colour transparency in order to judge of the colour effect. Any excess of the dye taken up may be reduced by careful rinsing of the plate, which is dried as soon as its depth is considered satisfactory.

In working the process care should be taken that the high-lights are not stained, which may easily happen if the transparency is too hard or printed too long. A suitable red dye is pinatype red, which has been used for its proper purpose to such an extent that it is no longer workable. Its permanence, which alone is extremely great, may be still further increased by laving the plate in a solution of alum, to which a little copper sulphate or ferrous sulphate has been added. On the film side of the yellow image the blue film is laid, and fastened with adhesive strips when obtained in register. The red image is similarly registered, and bound up with the yellow and blue print. The effect of these colour prints is extremely good, particularly in their rendering of the neutral tones, grey to black, and has been found well suited for the making of portraits in colours. So far as concerns the yellow and blue the permanency of the component prints is a matter of certainty, whilst the red print cannot be better formed than by the choice of such a dye as the pinatype red.—"B.J." (*Colour Supplement*), Nov. 1, 1907, p. 84, from "*Photographische Korrespondenz*."

A One-exposure Three-colour Camera.—Sir W. Abney read a paper before the British Association Meeting at Dublin, and exhibited his new one-exposure camera for three-colour work. He pointed out that any such camera for landscape work, or for amateurs generally, must be arranged so that—

- (1) The three images must fall on one plate so as to be developed together.
- (2) That the images must be of the same size, whether the objects photographed were near or distant.
- (3) That there should be a minimum of stereoscopic effect.

In the camera, as shown, for the ordinary lens was substituted a lens which consisted of three narrow strips placed side by side, each of which could be made of different foci; the rays coming through the two outer strips were deflected outwards by mirrors placed at 45° with their direction. The rays, after travelling the distance of the size of the desired picture, were again reflected by mirrors of 45° in a direction parallel to their first direction, and fell on to the focussing screen. The desired direction of the rays having been secured, it remained to devise some means for making the images of the same size on the focussing screen. This was done by placing in the paths of the rays second lenses of proper focal length.

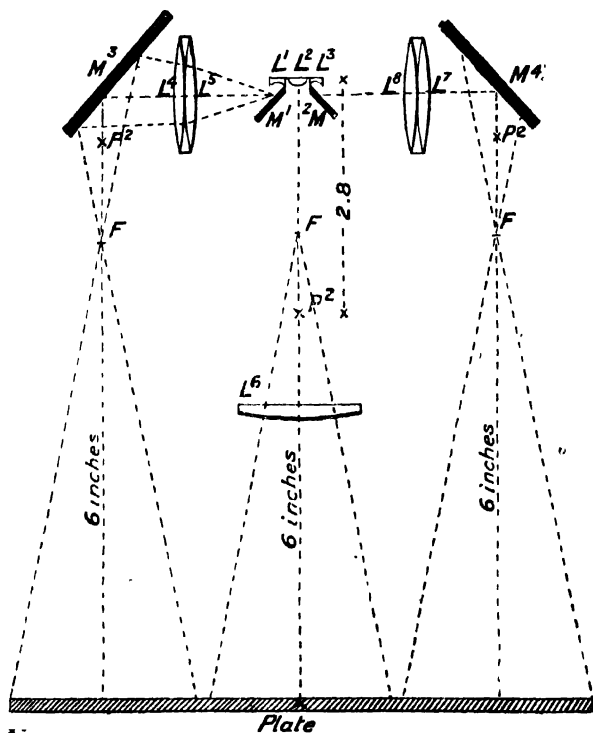
As a matter of fact, the focal lengths of the strips of lenses and of these second lenses had to be calculated, so as to give the required results. But in making the calculations an additional factor had to be taken into account, viz., that the distances of the second principal points of the combinations should be equal to one another, as by that means alone the size of image and focus of the combinations could remain equal for near objects.

The focal lengths of the various components are arrived at by forming sets of equations, both for the central and outside pairs, with an unknown interval between the lenses of the central pair, the separation of the lenses in the outside pair being more or less fixed by the position of the mirrors. The distance between the first lenses and the plate are also assumed as fixed. In the equations for the outside pairs we have only two unknown quantities f' and f'' : the known quantities F' , the focal distance from the plate, the separation being, as already said, fixed, and the distance of the plate from the front lenses. From these, two equations are formed, which give the focal lengths of the components of the pairs of lenses, as also the distance of the two principal points from the first and second lenses. For the central pair the known quantities are the focal length of the combination, the distance of the first lens from the plate, and the distance of the second principal point. The unknown quantities are f' , f'' , and s , the separation. Three equations are formed with the usual optical formulæ, and the unknown quantities are obtained from them.

[It may be remarked that had not the first lenses of the pairs all been side by side the results would have been useless, for near objects could never have been at the same distance from each of the three lenses.]

In this way the requirements of the lenses were calculated. The two front lenses 4^1 and 4^2 of the outside pairs are deeply concave and

the second lens, 4^3 4^5 , deeply convex with $1\frac{1}{2}$ ins. separation, but the front lens 4^2 of the central pair is moderately convex; the second lens 4^6 is also convex. 4^2 and 4^6 are placed about 4 ins. apart. The focal lengths of the lenses being fixed, the correction for the three colours are carried out in the curvature of the lenses dependent upon the glass employed. Mr. Dennis Taylor, who superintended with his usual skill the grinding of the lenses, recommended dividing the deep convex lenses of the outside pairs into two in order to obtain flatness of field.



The question of distortion was one that could not be overlooked. It is very small, and the curves have been so chosen that this small amount is practically the same in all three combinations.

Theoretically and practically the focussing screen may be racked out to any distance, and the images remain the same size. The mirrors M^1 , M^2 , M^3 , M^4 are of steel. Experiments recorded in text-books tell us that polished steel reflects 60 per cent. of white light, so with two reflections about 36 per cent. light ought to be reflected. With the

mirrors the writer employs the reflected light falling on the plate is about 25 per cent., but no very strong conclusion can be drawn from this approximate measure since the surfaces reflected more rays of low refrangibility than of high. A beam of white light is distinctly yellow after reflection.

The use of steel was adopted, as it is easy to work and rigid, and polishing is not difficult. Tarnish and destruction of the surface from damp is prevented by giving it a very thin coating of collodion varnish, which does not alter the reflective power appreciably, and does not distort the images. No doubt other material might be employed in the mirrors which would reflect more light, but the writer considers that steel has many advantages. After using the camera the writer finds it answers more than his expectations, and from the fact that a fairly wide angle, say of 36° , can be used, it is most convenient for landscape work, and the power of focussing renders it useful for portraiture or copying. The production of the three-colour negatives by one exposure instead of three makes three-colour photography a pleasure instead of an anxiety.--"Phot. Journ." Oct., 1908, p. 331.

THE BLEACH-OUT PROCESS.

Bleach-Out Paper.—Dr. C. E. K. Mees, from measurements of the "Uto" bleach-out paper made by Dr. J. H. Smith, finds that the light reflected from the surface is not of the same composition as that reflected from white paper, but contains two maxima of light with three absorption maxima between, the latter evidently corresponding to the three dyes: the first at 6,700 to blue-green, possibly methylene blue; the second at 5,600 to a magenta red; whilst a third in the violet is indicated at somewhere between 4,000 and 4,500. From actual exposures of the paper in the spectrophotometer it was seen that any one maximum can be bleached out by light of the colour which is absorbed falling upon it.--"B.J." (Colour Supplement), March 6, 1908, p. 17.

Bleach-Out Properties of Dyes.—P. Lazareff, in a paper on the examination of the bleach-out action of light on cyanin, pinachrome, pinaverdol, lepidin-cyanin, and chinaldin-cyanin, concludes that, within errors of observation, the decomposed dye in an absorption band is directly proportional to the absorbed energy and independent of the wave-length of the incident light. Only a small fraction of the absorbed radiant energy is used in the photo-chemical decomposition of the dye; the larger part is spent in warming the absorbent film.--"B.J." (Colour Supplement), May 1, 1908, p. 38 (from "Annalen der Physik").

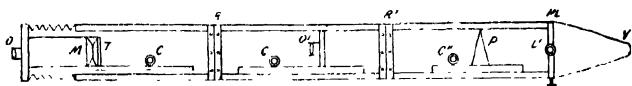
Improvements in "Uto" Paper.—Dr. J. H. Smith, in some notes on recent experiments of his on the making of "Uto" paper, states that he has traced the alteration in sensitiveness to different colours, which takes place on keeping, to the volatility of certain sensitizers. This can be overcome by adding substances capable

of "binding" the sensitisers, although this cannot be done completely, and it may be advisable to pack the sensitive paper in tinfoil. In printing from autochromes on "Uto" paper the latter may become so heated that the waxy vehicle of the starch grains actually melts, mixing up the colours and converting the autochrome into a positive in black and white. This difficulty is overcome by conducting a spray of water upon the cover glass of the printing frame during exposure. It is found that the sensitisers are more thoroughly removed by vegetable oils than by benzole, as formerly directed, or a solution of the oil in benzole is employed. —"B.J." (Colour Supplement), Sept. 4, 1908, p. 68.

THE PRISMATIC DISPERSION PROCESS.

The Prismatic Dispersion Process.—André Chéron has further improved the apparatus for the prismatic dispersion process (see "B.J.A.," 1908, p. 714). The unequal sharpness of the spectra over the whole surface of the image in consequence of the different angle of the rays falling on the prism is remedied by increasing the focal length of the second lens so as to reduce the angle at the edge of the plate. The apparatus, however, measures 43 ins. in length, although less than $4\frac{1}{4}$ ins. each way. For convenience of carrying it is made in three sections, each about 14 ins. in length, and hinged so that one section folds over another to the total dimensions of about 14 ins. long, 13 ins. high, and 6 ins. thick.

Connected to the first section by a bellows is the board for the first lens, at the focus of which are placed the first single lens and the screen. The whole is mounted on a board which can be moved backwards or forwards from the outside of the apparatus by a rack



O, O', lenses; M, single lenses; T, screen; C, C', " ", rack and pinions; R, R', hinges; P, prism; Pl, plate; L, L', micrometric screws; V, eye-hole.

and pinion. The middle section contains the second lens (long focus), also mounted on a movable panel.—"Phot. Couleurs," Nov., 1907, p. 161; "B.J." (Colour Supplement), Jan. 3, 1908, p. 3.

A further patent for the prismatic process is that of F. Urban (Eng. Pat. No. 8,723, 1907.—"B.J.," Nov. 15, 1907, p. 869).

APPENDIX TO EPITOME.

The exigencies involved in the arrangement of the volume render it necessary to place the two following articles somewhat out of their proper place in the volume.—Ed. "B.J.A."

CARBON PRINTS VIA BROMIDE.

The "Carbograph" Process.—"Carbograph" tissue is paper carrying a bromide emulsion, with which is incorporated a pigment. The paper is exposed to light like any other bromide paper and developed (with ferrous oxalate or ferrous citrate developer) either by inspection, in the case of a light pigment, or, by time, in the case of a dark pigment. Before fixing, the print is placed in a bath of bichromate, the action of which on the silver image is to form a print in insoluble gelatine, which is then developed in the usual carbon way, in hot water after transference to a final support. The process is thus a development of the method of Leon Warnerke described to the Royal Photographic Society in May, 1881. The series of operations in "Carbograph" is thus as follow:—

Exposure of a bromide paper.

Development as for bromide paper, five to seven minutes.

Clearing and rinsing, five minutes in all.

"Sensitising" in bichromate, three minutes.

Rinsing, two minutes.

Transfer to final support, ten minutes.

Development in hot water, about five minutes.

Fixing in hypo and washing, about half an hour.

C. Welborne Piper, in reporting on the process, emphasises the following points:—

The print is lightened by removing the silver image with a reducer.

All details were visible during development in the case of the lighter coloured tissues; the darker tissues were developed by time for five minutes in each case.

Stale sensitiser causes the effect of bad under-exposure, and the whole image may wash out in the hot water.—"B.J.," Nov. 15, 1907, p. 860.

From the official instructions for working "Carbograph" the following is taken:—

The negatives must be safe-edged as for the carbon process.

The tissue is equivalent in sensitiveness to medium speed bromide paper, and must be handled in orange-yellow light.

The following numbers give the times of exposure compared with "Rotograph" bromide paper:—

Engraving black	9 times.
Photo-brown	10 times.
Red chalk	10 times.
Light green	7 times.
Warm sepia	5 times.
Cold sepia	8 times.

e.g., if "Rotograph" bromide paper requires 10 seconds, cold sepia "Carbograph" will require 80 seconds.

Development must be with ferrous oxalate or ferrous citrate, other developers, owing to their tanning action on the gelatine, being unsuitable.

The developed print is cleared, as usual, in 1 in 100 acetic acid, and rinsed in three or four changes of water.

Sensitising is done in:—

Potass. bichromate	2 ozs.	40 gms.
Water	50 ozs.	1,000 c.c.s.
Potash alum (10 per cent. solution)	1 oz.	20 c.c.s.

Filtered after use and kept in the dark.

The print is immersed for three minutes, with the usual precautions as to airbells, temperature, and fingering, as in carbon. It is then given two or three changes of water before transferring. In transferring it is squeegeed to a piece of well-soaked transfer paper, and left under light pressure for fifteen minutes before development, as in carbon work.

Development, again, in no wise differs from the carbon method.

Fixing is the next process—for ten or fifteen minutes in hypo 4 ozs., water 20 ozs., after which the print is washed to remove the hypo, hardened in—

Alum, 1 oz.; water, 100 ozs.,

to prevent accidental damage to the film, rinsed and hung up to dry.

To remove the silver image, Farmer's reducer is used, afterwards well washing until all yellowness has disappeared. But if the silver image is left in, intensification of this part of the image can be done by any suitable process. (The chromium intensifier is the most suitable.—Ed. "B.J.A.")

ARRESTING THE PROCESS HALF-WAY.

If a large number of prints are required the following method may be substituted so as to divide the process into two distinct parts:—After developing and clearing the bromide image, the "Carbograph" is sensitised in the bichromate solution as usual, only it is advisable in this case to use only a half quantity of the added 10 per cent. solution of potash alum to the sensitiser, which would read 10 c.c.s., or half an ounce, instead of that given in the formula. After sensitising and rinsing the print should be fixed and washed, in accordance with the instructions already given, and then allowed to dry.

The transfer of the tissue to its support, and its subsequent hot-water development, can then be carried out at any later date within the limits generally allowed for ordinary sensitised carbon tissues (five to seven days) so long as it is properly stored meanwhile.

Prints which are prepared by this method are much less liable to damage in handling whilst wet than those finished without intermediate drying; but, of course, this method increases the length of time necessary for producing results, and so annuls some of the advantages of the "Carbograph" process.

The squeegee for "Carbograph" work is important. If too hard the tissues are likely to be too roughly treated. A squeegee of easily flexible rubber should be used.—"B.J.," Nov. 15, 1907, p. 860.

- *Control of Contrast.*—C. Welborne Piper recommends that the contrast be lowered by selecting a light-tone pigment. Considering the brown tones available in "Carbograph," and ignoring the effect of after-reduction, we have two light toned browns in cold and warm sepia. Either of these gives a soft image from a negative of ordinary pluck and density, though the same negative may give hard results with blocked up shadows if we use "photo brown," "engraving black," or "red chalk." It should be noted that the "engraving black" is not a pure black—such a colour is hardly necessary in a carbon process—it is a very deep brownish black which may perhaps best be described as an extremely dark sepia. The "red chalk" is also a brown of a very red tint if the silver is not removed by Farmer's reducer. If, however our negative is very thin and soft we can gain pluck and contrast in the enlargement by using one of the three papers last mentioned, "engraving black" being perhaps best suited to the thinnest negative, while of the other two "photo-brown" gives the strongest result.—"Photo. Notes," March, 1908, p. 49

After-Treatment of "Carbograph."—Some results of experiments by C. Welborne Piper are as follows:—The image of the finished print contains silver as well as pigment, and the colour is more or less affected by the presence of the black silver image. This black image can be removed, intensified, or toned, hence the final result can be modified. Farmer's reducer removes the black silver image, lightens the colour, and materially diminishes the contrast. Intensification of the silver image darkens the colour and increases the contrast slightly. Sulphide toning warms the colour without very materially affecting contrast. Iodising the silver image gives a still warmer colour and diminishes contrast slightly. The effects obtained, of course, vary with the colour of the pigment, and there is scope for experiment with other modes of after-treatment.—"Photo. Notes," Jan., 1908, p. 4.

THE LIPPMANN STEREO LENS-PLATES.

A plate formed somewhat on the lines of the eyes of certain insects—that is, consisting of an assemblage of minute lenses—has been devised by Professor Lippmann for the production of positives on glass, giving directly, and without a lens, the sensation of relief peculiar to stereoscopic views. Not only is this relief more exact, but the perspective changes according to the angle from which the plate is viewed, an approximation to nature not hitherto attainable



FIG. 1.

by any instrument. And all this on one plate exposed in a simple dark-slide to the landscape or object without intervention of objective or camera.

The arrangement by which these remarkable results are secured is as follows:—A film of celluloid or collodion, with a species of honeycomb structure, is prepared. Before coating with the emulsion, whilst still warm or unset, imagine it impressed by a plate so hollowed *in petto* as to cover the film with a relief of small hemispherical surfaces. This is done for both sides. The anterior hemispheres, intended to act as lenses, have a smaller radius of curvature than the posterior ones, which are covered with a sensitive emulsion. Each cell of the latter should receive an image formed by one of the small lenses of the anterior surface. Fig. 1 shows an enlarged section of such a film.

It is necessary that each of the corresponding segments should have the same curvature, and that the relation between the radii of curvature of the front and back hemispheres be equal to $n-1$, where n is the index of refraction of the medium—*e.g.*, collodion. The front hemispheres form a series of lenses, the back ones, the photographic plate, the curvature of which ensures an exact focus over its entire surface, just as in spectrographs plates and films are bent to the curvature of a particular grating. The whole cell acts as a small camera, comprising lens, camera, and film. The intervening wall between any two cells has to be rendered opaque so that very oblique rays cannot pass from one cell to another. The actual film thus consists of a layer of these cells juxtaposed, and all identical in size and disposition.

We may now consider the formation of an image of any object, and the reproduction of the same obtained when the plate is viewed.

As the focal length of each little lens is only a fraction of a millimetre, all objects beyond a slight distance will be in focus. Each forms on each corresponding section of the sensitive film a microscopic image of the landscape, which varies slightly from

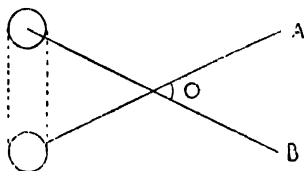


FIG. 2.

point to point as the angle of incidence changes. We have formed, therefore, a large array of images of the object, just as the multiple eye of a beetle forms numerous images. Suppose the film developed to a positive and viewed as a transparency from the side L. We shall not see the juxtaposed array of images as might be expected, because (by virtue of its accommodation) the eye only perceives one point of each image, and the assembly of all these points forms a complete image the size of the plate. As the position of each point perceived varies according to the angle from which the plate is viewed, we can follow the panorama across the plate exactly as in

Regarding the same scene in nature from different points of view. Moreover, the reproduction will be in perfect relief, giving exactly the same sense of perspective.

Consider in Fig. 2 any point *a* in one of the small images. The rays issuing from *a* are all parallel, since by construction *a* is at the focus of the lens. The eye at *O* will perceive them as if coming from the point *a* projected to infinity in the direction of *AOa*. Further, the direction of the emergent bundle is exactly that of the incident bundle which during exposure was concentrated on *a*. Hence the eye perceives the photographic image of *A* as though projected in space in the direction joining the optical centre of the eye to the point *A*. The same holds for any other point *B*. The directions being preserved, the angles and apparent magnitudes also remain the same. It follows that the real images thus formed occupy in space, with respect to the system of cells and to one another, the same position as the original points, forming images optically equivalent and in three dimensions to the object reproduced. Through its accommodation the eye will perceive them in the aspect proper to the point of view. This changes with the position of the eye, and as we have two eyes in different positions this imposes the corresponding perspectives, and the condition of sensation of relief is thus obtained without the use of a stereoscope.

The image thus formed is obtained as a negative on development, and is also geometrically reversed. The reversal of the image may be secured by developing to a positive, as with Autochrome plates, or, better, by copying the negative on to a second film placed at an arbitrary distance of some centimetres from the first, contact not being necessary, since the process is only a repetition of the original procedure. This method has the advantage of giving any desired number of positives.

In order that the multiple images may give only one impression to the eye, the cells must be sufficiently small and near together, the condition being that the distance between two cells be less than the pupillar opening.

In any given position the image is limited by the edges of the plate, like a landscape viewed through a window. But on moving the head other objects will appear in the same limits, so that one can perceive a complete panorama pass over the plate. The remarkable capacity for seeing a series of views in succession on the same plate arises from the curvature of the component elements. When viewed directly, the image seen is the summation of elements, each of which lies at the centre of the small cellular elements scattered over the plate. If regarded obliquely the summation extends over elements present in the lateral portions of the cells. If the aperture of these is 120 deg. it follows that 120 deg. of the landscape is included, this being comprised in each elemental cellular image. If we imagine the film bent to a cylinder, one could sweep 360 deg., and with ellipsoidal or spheroidal surfaces take in the heavens and the earth as well as the horizon, thus making the resemblance to certain insects' eyes more complete.—"B.J.," March 13, 1908, p. 192.

KEY TO THE ABBREVIATIONS OF JOURNALS QUOTED IN "EPITOME OF PROGRESS," WITH ADDRESSES OF THOSE PUBLISHED IN FOREIGN COUNTRIES:—

- "A. P." "The Amateur Photographer."
Since May 12, 1908, including also the "Photographic News." See "P.N."
- "Amer. Phot." .. "American Photography."
361, Broadway, New York City, U.S.A.
- "Ann. Gen. Phot." .. "Annuaire Général de la Photographie."
Plon-Nourrit & Co., 8, Rue Garancière, Paris.
- "Ann. Chem. Phys." "Annales de Chimie et de Physique."
Masson et Cie., 120, Boulevard St. Germain Paris.
- "Apollo" "Apollo."
Albrechtstrasse 39b, Dresden A, 10, Germany.
- "Atelier" "Das Atelier."
W. Knapp, Halle a/Saale, Germany.
- "Aust. Phot. Journ." .. "Australian Photographic Journal."
Harrington & Co., Ltd., 386, George Street, Sydney, Australia.
- "Aust. Phot. Rev." .. "Australian Photographic Review."
Baker & Rouse Proprietary, Ltd., 375, George Street, Sydney, Australia.
- "B. J." "The British Journal of Photography."
- "B.J.A." "The British Journal Photographic Almanac."
- "B. M." "Photo-Notes and the Bromide Monthly."
- "Berichte" "Berichte der Deutschen Chemischen Gesellschaft."
R. Friedlander & Sohn, Karlstr. 11. Berlin, N.W.
- "Bild" "Das Bild."
Neue Photographische Gesellschaft, Steglitz, Berlin.
- "Brit. Opt. Journ." .. "The British Optical Journal."
- "Bull. Belge" "Bulletin de l'Association Belge de Photographie."
Ch. Puttemans, Palais du Midi, Brussels.
- "Bull. Fr. Chem. Soc." "Bulletin of the French Chemical Society."
Masson et Cie., 120, Boulevard St. Germain, Paris.
- "Bull. Soc. Fr. Phot." "Bulletin de la Société Française de Photographie."
Gautier-Villars et Fils, Quai des Grands-Augustins, 55, Paris, France.
- "Bull. Phot." "Bulletin of Photography."
Washington Building, 608, Chestnut Street, Philadelphia, U.S.A.
- "Cam." "The Camera."
606-608, Sansom Street, Philadelphia, U.S.A.
- "Cam. and Dk. Rm." .. "Camera and Dark Room"
(now incorporated with "Amer. Phot.").

- "Cam. Craft" .. "Camera Craft."
713/715, Call Building, San Francisco, Cal., U.S.A.
- "Cam. Work" .. "Camera Work."
Alfred Stieglitz, 1111, Madison Avenue, New York, U.S.A.
- "Cent. Zeit." .. "Central Zeitung für Optik und Mechanik"
7, Bülowstr., Berlin, W., Germany.
- "Chem. News" .. "The Chemical News."
- "Chem. Zeit." .. "Chemiker Zeitung."
Dr. G. Krause, Cothen, Germany.
- "Compt. Rend." .. "Comptes-Rendus des Séances de l'Académie des Sciences."
Gautier-Villars, 55, Quai des Grands-Augustins, Paris.
- "D. Phot. Zeit." .. "Deutsche Photographen-Zeitung."
K. Schwier, Weimar, Germany.
- "Der Amateur" .. "Der Amateur."
Mondscheingasse 6, Vienna VII, Austria.
- "Der Phot." .. "Der Photograph."
Benno Fernbach, Bunzlau.
- "Eder's Jahrbuch" .. "Jahrbuch für Photographie und Reproduktionstechnik."
W. Knapp, Halle a/S., Germany.
- "Focus" .. "Focus."
Amalgamated May 12, 1908, with "Photography" under the title "Photography and Focus."
- "Il Prog. Foto." .. "Il Progresso Fotografico."
R. Namias, 27, Via Boccaccio, Mailand, Italy.
- "Journ. Chem. Soc. Trans." .. "Journal of the Chemical Society: Transactions."
- "Journ. Phot. Soc. Ind." .. "Journal of the Photographic Society of India."
40, Chowringhee, Calcutta, India.
- "Journ. Roy. Micr. Soc." .. "Journal of the Royal Microscopical Society."
- "Journ. S. C. I." .. "Journal of the Society of Chemical Industry."
- "Journ. Soc. Arts" .. "Journal of the Society of Arts."
- "Knowledge" .. "Knowledge."
- "Le Phot." .. "Le Photo Journal."
22, Rue Varenna, Paris.
- "Mon. Phot." .. "Le Moniteur de la Photographie."
17, Rue des Moines, Paris, France.
- "N. Z. Phot." .. "Sharland's New Zealand Photographer."
Lorne Street, Auckland, N.Z.
- "Nature" .. "Nature."
- "Oest. Phot. Zeit." .. "Oesterreichische Photographen Zeitung."
Oesterreicher Photographen-Verein, Vienna III/I.
- "Opt." .. "The Optician."
- "P. M." .. "The Photo-Miniature."
289, Fourth Avenue, New York, U.S.A.
- "P. N." .. "The Photographic News."
Amalgamated May 12, 1908, with the "Amateur Photographer" under the title "Amateur Photographer and Photographic News."

"Pgm."	"The Photogram"	4
	(now the "Photographic Monthly").	
"Pharm. Journ." ..	"The Pharmaceutical Journal."	
"Phil. Mag."	"The Philosophical Magazine."	
"Phil. Trans." ..	"Philosophical Transactions of the Royal Society."	
"Phot."	"Photography."	
	Since May 12, 1908, including also "Focus," which see.	
"Phot. Chron." ..	"Photographische Chronik."	
	W. Knapp, Halle a/Saale, Germany.	
"Phot. Couleurs" ..	"Le Photographie des Couleurs."	
	118, Rue d'Assas, Paris.	
"Phot. Indus." ..	"Photographische Industrie."	
	Dresden-A., 21, Germany.	
"Phot. Journ." ..	"Journal of the Royal Photographic Society of Great Britain" ("The Photographic Journal").	
"Phot. Korr."	"Photographische Korrespondenz."	
	Bäckerstrasse 12, Vienna I, Austria.	
"Phot. Kunst" ..	"Photographische Kunst."	
	Rennbahnstrasse 11, Munich, Germany.	
"Phot. Mitt."	"Photographische Mitteilungen."	
	Gustav Schmidt, Königin Augustastr. 28, Berlin W. 10, Germany.	
"Phot. Monthly" ..	"The Photographic Monthly."	
"Phot. Rund." ..	"Photographische Rundschau."	
	W. Knapp, Halle a/S. Germany.	
"Phot. Scraps" ..	"Photographic Scraps."	
"Phot. Times"	"The Photographic Times."	
	39, Union Square, New York City, U.S.A.	
"Phot. Welt"	"Photographische Welt" (formerly "Der Amateur Photograph").	
	(M. Eger), 28, Grimmaischer Steinweg, Leipzig Germany.	
"Phot. Woch."	"Photographisches Wochenblatt."	
	1 ¹ , Bendlerstr., Berlin, W.	
"Photo-Beacon" ..	"The Photo-Beacon"	
	(now incorporated with "American Photography.")	
"Photo-Era"	"Photo-Era."	
	383, Beylston Street, Boston, Mass., U.S.A.	
"Photo Gazette" ..	"Le Photo Gazette."	
	14, Rue des Minimes, Paris, France.	
"Photo-Revue"	"Photo-Revue."	
	118, Rue d'Assas, Paris VI, France.	
"Photographer" ..	"The Photographer."	
	76, Fifth Avenue, New York, U.S.A.	
"Photographie" ..	"La Photographie."	
	118, Rue d'Assas, Paris, France.	
"Phys. Rev."	"The Physical Review."	
	The Macmillan Company, 66, Fifth Avenue, New York, U.S.A.	
"Pract. Phot."	"The Practical and Pictorial Photographer."	
"Pro. and Am. Phot."	"The Professional and Amateur Photographer."	
	222, Washington Street, Buffalo, U.S.A.	

- "Proc. Roy. Soc." .. "Proceedings of the Royal Society."
 "Procédé" .. "Le Procédé"
 150, Boulevard de Montparnasse, Paris XIV.
 "Rev. Phot." .. "Revue de Photographie."
 Issued only as Annual since Dec., 1907.
 "Rev. Trimest." .. "Revue Trimestrielle des Travaux de
 -Recherches"
 A. Lumière et ses Fils, Lyons.
 "Sci. Amer." .. "The Scientific American."
 Munn & Co., 361, Broadway, New York, U.S.A.
 "Sonne" .. "Sonne."
 Kaiser-Platz, 18, Wilmersdorf, Berlin.
 "St. L. and C. Phot." "The St. Louis and Canadian Photogra-
 pher."
 911, N. Sixth Street, St. Louis, Mo., U.S.A.
 "St. Ver." .. "Saint Veronica"
 Ceased publication, 1907.
 "T. Q." .. "Telephoto Quarterly."
 "Wiener F. Phot. Zeit." "Wiener Freie Photographen Zeitung."
 Gustav Walter, Alserstrasse 71, Vienna VIII,
 Austria.
 "Wien. Mitt." .. "Wiener Mitteilungen."
 Graben 31, Vienna I, Austria.
 "Wilson's" .. "Wilson's Photographic Magazine."
 289, Fourth Avenue, New York, U.S.A.
 "Yr. Bk. Phot." .. "The Year Book of Photography."
 Amalgamated with "B. J. Almanac," 1908.
 "Zeit. fur Instr." .. "Zeitschrift für Instrumentenkunde"
 Julius Springer, Berlin.
 "Zeit. für Repro." .. "Zeitschrift für Reproduktionstechnik."
 Wilhelm Knapp, Halle a/Saale, Germany.
 "Zeit. für Wiss. Phot." "Zeitschrift für Wissenschaftliche Photo-
 graphie."
 J. A. Barth, 17, Ratsplatz, Leipzig, Germany.

CANADA AS A FIELD FOR PHOTOGRAPHERS.

[We are so often asked about the present conditions in Canada as they require to be known by a photographer with thoughts of going to that country, that we may direct special attention to the following article, written at our request by a Canadian reader, Mr. David J. Howell, of the "B J. Almanac," familiar both with the country and with the photographic business.—ED. "B.J.A."]

A great deal has been said and written of the vast extent of the Dominion of Canada. As the literature issued by its Government and railways goes into this fully, it will not be necessary to describe it. One or two facts, however, should be kept in mind. Canada is a land of great distances. It requires about a week to traverse it by express train, and it has almost as great a variety of climate as Europe. To give an idea of its resources and possibilities it will be best to deal with the country in sections.

The Maritime Provinces, Nova Scotia, Prince Edward Island, and New Brunswick, have not attracted so much attention from newcomers as have the provinces to the west, yet they have made steady progress. In addition to their fisheries, lumbering, and shipping, the growth of iron and steel industries, and the development of coal fields, are perhaps the more recent outstanding features of their progress. Some parts are attracting an increasing number of summer tourists, notably the Annapolis Valley in Nova Scotia, the most famous apple orchard country in Canada, and known to tourists as "the land of Evangeline." In Nova Scotia the principal city is Halifax, the capital, with a population of 40,000. It is a seaport, open all the year, and the winter port for the Canadian mail steamers. It is a thorough English city, and regarded by western Canadians as being somewhat sleepy. Sydney, where the great steel and coal industries are centred, has a population of 9,000.

In New Brunswick, St. John (40,000 population) is the largest business place, being the winter port of the steamers of the Canadian Pacific Railway, and where they have built extensive docks. The city has every prospect of substantial growth. Fredericton, the capital, with a population of 7,000, and Moncton (9,000) are the other important places.

The province of Quebec, being almost wholly occupied by French-speaking people, who are perhaps less aggressive than the English of the other provinces, offers very few attractions as a place of settlement for the Anglo-Saxon from over the seas. Quebec, the capital of the province, is considered the most picturesque and quaint city in America. It attracts a great number of tourists, who sometimes come in such numbers as to exceed the large hotel accommodation. It is the summer port of several trans-Atlantic lines of steamships, and has recently experienced a revival of business and growth. Less than a quarter of its population of 70,000 are English-speaking people.

• Montreal, some 200 miles further up the river St. Lawrence, is the metropolis of Canada. It has a population of nearly 400,000, of which about two-thirds are French. Though a university city, with many English and French colleges, it has more and larger manufacturing industries, and a greater amount of shipping, than any city in Canada. The head offices of the two great railway systems are situated here, and each maintains a fully equipped photographic department. Some of the large manufacturing plants employ a photographer for their work exclusively.

CENTRAL AND WESTERN CANADA.

It is in the central and western parts of Canada, however, that the greatest progress and development is taking place, and to these provinces the greatest attention is attracted. The southern part of Ontario has been well settled for many years, and the majority of farms have substantial buildings and highly cultivated fields. Many of these homesteads have been in the possession of their owners for several generations. The cities and towns are of considerable size, and in many there are manufactories of various kinds, whose products are sent all over the Dominion, or exported.

Ontario at present is the chief manufacturing province; its capital, Toronto, is a city of 300,000 population, almost wholly English-speaking. It has a large university and many colleges, there being 5,000 students in attendance. There are many and extensive manufactories. The latest directory of the city showed sixty-three photographic establishments. Most of these are one-man studios, the proprietor doing all the operating and employing one or more assistants.

The other principal cities are:—London, population 35,000; Hamilton, 55,000; Ottawa, the capital of the Dominion, population 70,000, partly French; and Kingston, 25,000, the conditions being somewhat like Toronto on a smaller scale. Hamilton, perhaps, has more industrial concerns than the others.

The northern and western part of the province, usually termed New Ontario, is largely undeveloped. Great interest at present centres in the extensive and valuable minerals recently discovered. Cobalt silver ore of marvellous richness has attracted the world's attention. This region is about eleven hours' railway journey from Toronto. Already the more adventurous photographer has been "cleaning up" good money there. North of this, large areas of good farming land are being opened up by the building of railways. To the west of this territory is a wild and rough country, much of it mineral-bearing, and largely forest-covered. All this north country has long, rigorous winters, but bright, warm summers that attract great numbers of people from older Ontario and the United States.

At the head of the great lakes are the twin cities of Port Arthur and Fort William. They will eventually form a large city, for all the lake traffic to and from the Great West begins and ends here.

It has large terminal facilities for three railways, among these being some of the largest grain elevators in the world. At present the photographic possibilities have been largely discounted, and competition is keen. Back of these cities, and to the west, large lumbering and mining operations are being carried on, Kenora, a thriving place, being their centre, and the most western town of prominence in Ontario.

THE WHEAT-GROWING DISTRICTS.

Manitoba, is the first of the prairie provinces, and the beginning of the great wheat-growing lands that stretch through to the Rocky Mountains. Its capital, Winnipeg, is the first city of Western Canada, the growth and progress of which has been so rapid, and yet substantial, as to be nothing short of marvellous. Its citizens are very much impressed with the achievement, and no comparison or eulogy, however flattering, is received by them with other than the utmost complacency. There is a great amount of business done; every year sees an increasing number of manufacturing industries established. The city has many nationalities among its inhabitants, but the English-speaking races are very largely in the majority. Its population has nearly trebled in the last five years, and is now somewhere about 125,000. There were about twenty photographic studios in the city in 1907. The province of Manitoba is fairly well settled, and many thriving towns are located on its extensive network of railways, Portage la Prairie (5,000) and Brandon (11,000) being the most important.

Two new provinces (Saskatchewan and Alberta) lie between Manitoba and the Rocky Mountains. The first in the westward journey is Saskatchewan, with an area of nearly 250,000 square miles, being 700 miles from south to north, and over 400 from east to west. Wheat-growing, ranching, mixed farming, and lumbering in the north, are the special industries of the province. The principal towns are Regina (7,000), the capital, Moose Jaw (7,000), Prince Albert (4,000), Saskatoon (2,500). There are a number of lines of railway under construction, and new towns are springing up continually. Alberta has even greater area than its sister province, containing over 280,000 square miles. It has, perhaps, the greatest possibilities of the western provinces, having a great variety of natural resources. In addition to wheat-growing, cattle-raising, mixed farming, and great lumbering possibilities, it has rich mineral deposits, coal, gold, silver, and other minerals; oil and gas have been found in many districts. It has some good-sized towns, the most important being Calgary (15,000), Edmonton (12,000), Strathcona (3,500,) and Medicine Hat (3,500).

BRITISH COLUMBIA.

British Columbia marks the western limit of Canada. It is a mountainous country of great extent, with many fertile valleys, which are very favourable for all agricultural pursuits, fruit-growing being, perhaps, the most interesting at present. It is the

mineral wealth of the country that has attracted the most attention, gold, silver, lead, iron, and coal being found and mined in large quantities. At the coast the climate is mild and moist. Nearly every variety of climate can be found in this province, excepting, of course, that of a tropical or semi-tropical nature. There have been many labour troubles, and at present the influx of Japanese and Hindoos is causing very serious concern, not only in the province, but in the rest of Canada. Their presence makes it difficult for a white man to obtain employment in the callings which do not require skill. In the fisheries, in the hotels and restaurants, the white men have nearly all been driven out by this cheaper labour. It is a country of wonderful resources, which are being developed in spite of these difficulties. There are perhaps more people of United States origin than in any other province, and their business methods and requirements are more akin to the States than Eastern Canada. Vancouver, population 50,000, and Victoria, the capital (25,000) are the two largest cities.

CANADIAN RAILWAY DEVELOPMENT.

The railways of Canada are a very important factor in its life and development, and no account of the country, however brief, can very well omit some mention of them. The Canadian Pacific Railway, or the "C.P.R.," as everyone in Canada calls it, extends from the Atlantic to the Pacific, and with its many branches makes a system of over 9,000 miles, the greatest mileage under one management in the world. It is the one Transcontinental road at present, but there are under construction two other systems—the National Transcontinental Railway and the Canadian Northern, the former being built by the Government and to be operated by the Grand Trunk Pacific Railway, which is closely identified with the present great system of the Grand Trunk. The latter has already in operation many links of its proposed line across the continent. All of these railways are extending their branches into new territory. There are two Government-owned railways—the Intercolonial, running from Halifax to Montreal, owned and operated by the Dominion Government; and a short railway into the Cobalt mining region, owned and operated by the Government of the province of Ontario.

PHOTOGRAPHERS' OPPORTUNITIES.

In all these western provinces there are, and will be, openings for photographers. Success will come to the man who grasps the conditions and understands the requirements of the people. The average grade of work—at least, along the main line of the C.P.R. is high; as good, if not better, than the average work in Toronto and Montreal. The plates, paper, mounts, are almost exclusively of Canadian (Eastern), or United States manufacture, the prevailing styles, if such a term can be applied to photographic work, are wholly American, and a man starting business without a knowledge of these special conditions would be seriously handicapped.

It would be almost essential for a man intending to start business in any part of Canada to obtain a position in an established "gallery," as the photographic studios are called, learn the conditions, and at the same time be on the look-out for a desirable location by getting in touch with the travellers (travelling salesmen) of the stock houses, as the dealers in photographic materials are termed.

This advice will also apply to apparatus. A man can decide better when he is on the ground what lenses and cameras he will need than he can in anticipation, and when he is not wholly familiar with the conditions. Some of the equipment can be purchased for less money in Canada than it would cost to import from Britain, though most of the lenses used in Canada come from there. Good lenses can be purchased in England for considerably less, and are comparatively easily carried.

QUALIFICATIONS FOR BERTHS IN CANADA.

There are openings for portrait operators, printers, and commercial photographers in Canada, but the men must know their business, *but not too well*. Good men will have very little difficulty in getting placed. The general experience of Canadian photographers with British help has not been at all satisfactory, mainly because the greater number have been incompetent. They do not try to learn the methods of their employer because "that is not the way they did it in England," and when given a free hand in printing and toning often turn out a batch of prints that are not fit to go out. As one photographer said to the writer, a certain batch referred to "looked as if an amateur had been trying his hand at it."

Most photographers in Canada, however long they have been at the business, are always ready to learn of and adopt a better way of doing the work, but the new hand should become proficient in his employer's methods, and then, if he knows he can improve on it, he will surely be given a chance to demonstrate the fact.

Perhaps the typical Canadian photographer in business is too cocksure, but if his new helper from over the sea is inclined that way he had better dissemble until he has "made good." The man who pays has perhaps some justification in wanting things done in the way he believes the best way. In regard to wages, in Central and Eastern Canada a printer will get from 9.00 dols. (36s.) to 15.00 dols. (60s.) per week. A man who can operate, retouch, print, and finish if occasion requires it, is paid from 12.00 dols. (48s.) to 18.00 dols. (72s.) per week; some high-class portrait operators get from 15.00 dols. (60s.) to 25.00 dols. (£5).

KINDS OF WORK—AND PRICES.

In the better class of portrait work collodion paper with a "carbon" finish (Aristo-platino) is almost wholly used. It is toned with gold and platinum. However, the use of some superior grades of gaslight paper is increasing. Cheap work and commercial work is largely finished in a gelatine printing-out paper,

though gaslight paper is often employed. The highest quality work, however, is printed in black or sepia platinum. Carbon is rarely used.

Prices for finished portraits vary very greatly. In Ontario small sizes, less than c.d.v., will go as low at 50c. (2s.) per dozen, in the low-priced galleries, while sizes around the quarter-plate run from 75c. (3s.) up to 2.50 dols. (10s.), while cabinets range from 1.00 dol. (4s.) up to 12.00 dols. (48s.) per dozen, 4.00 dols., 5.00 dols., and 6.00 dols. (16s., 20s., and 24s.), however, being considered a good price for fairly good work, 7.50 dols. up to 12.00 (30s. to 48s.) being obtained only by a few of the higher-class photographers who have made a reputation among the more fashionable element. For large work it is difficult to give a scale of prices.

In Manitoba and the West the prices for average work are nearly double what they are in Ontario, while wages are only about 25 per cent. higher. The sparser population and greater cost of material will perhaps not give the photographer a greater profit.

LIVING AND CLOTHING.

In regard to the cost of living in Canada, rents in the cities are high in good localities, both for the studio and residence. In the smaller towns the rents are quite reasonable. Food costs about the same in Ontario as in England; meat is perhaps less. Clothing nearly twice as much. The slightly higher wages in the west represents pretty accurately the increased cost of living. It is perhaps desirable for any person coming to Canada with the intention of settling in the country to bring a good supply of clothing. In the case of men there is not much danger of being out of style for some time, though this cannot be said for women's clothing. The average Canadian dresses well—better than the same class in England—and a woman might soon find what she considered attractive in England become very ordinary or peculiar when contrasted with the clothing of her new acquaintances.

Almost anything can be got in Canada in the way of clothing with very little trouble; the advantage one would have, after getting here, of knowing what is suitable and what is wanted will more than offset the increased cost.

In regard to taking up land, and growing grain, raising cattle, or fruit farming, men from the older provinces, and from Britain or other parts of Europe, have been successful, although without experience, or at least with very little, when getting to the Western country. This can be done again by those of considerable adaptability, with determination and hard work. Some capital is essential. The free land is rapidly becoming more inaccessible, railways and land companies having obtained great areas. They are selling these at fairly reasonable rates. Full information about land, and the possibilities, can be obtained from the offices of the Canadian Government, or the Canadian Pacific Railway in London.

The marvellous resources of the country are being vigorously developed, but though substantial progress has been made, it can

still be said that this has really only begun. The financial stringency of last year checked it very slightly; the prosperity of the country is real and sound—perhaps more so now than before tight money induced greater caution and care. The outlook for the future is full of the greatest promise.

Those in older Canada are continually hearing of friends who have become prosperous in the West. These good reports are taking increasing thousands there every year. It certainly seems the land for young men. Britons have made their mark the world over; they are doing so in Canada, and why not in its land of promise, the North-West?

There does exist in Canada a certain amount of prejudice against British emigrants, particularly Englishmen, largely due to so many incompetent people sent out here by charitable (?) organisations. This will have to be reckoned with by those who come out. The man or woman who is not afraid to work, and forgets for a little while how superior everything is in England, will be cordially welcomed, and will find as warm hearts and kindly faces in the new country as any place in the world.

RECENT NOVELTIES IN APPARATUS.

BY THE EDITOR.

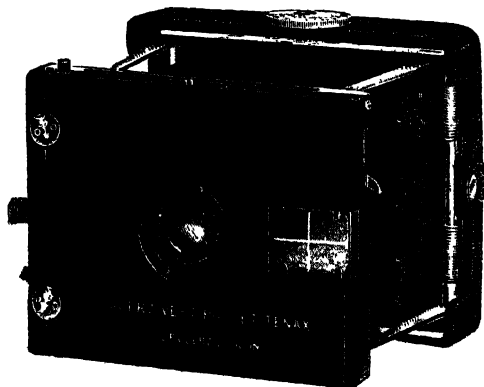
[These notices are confined to apparatus introduced since the publication of the last Almanac. In all cases the various articles have come under our personal examination, a rule from which we allow no departure.]

[The items in this section are indexed in the General Index to Text placed at the end of the volume.]

THE GOERZ VEST POCKET "TENAX" CAMERA.

(Made by C. P. Goerz Optical Works, Limited, 1 to 6, Holborn Circus, London, E.C.)

A beautifully made camera, taking plates $4\frac{1}{2} \times 6$ cm. ($1\frac{3}{4} \times 2\frac{3}{8}$ ins.), is the latest introduction of the Goerz factory, and represents a triumph of construction in small folding cameras of the highest class. The camera is of the so-called "klapp" pattern—that is, extending on four struts, which in the case of the "Tenax" are fitted with strong coiled springs, so that the front comes forward



simply on unlatching, and is most rigidly held before the plate. The camera is fitted with a Goerz Series III. "Dagor" of 75 mm. (3 ins.) focus, with shutter mounted in it. Both front and back combination can be unscrewed from the mount with the aid of a metal tool carrying at its extremity a pair of fine points exactly

fitting two tiny apertures in the lens mount. The shutter has adjustments for time exposures and for a series of instantaneous of $\frac{1}{2}$, 1-10, 1-25, 1-50, 1-75, and 1-100 of a second. There is also a sliding shutter which covers the lens and another which gives the three apertures of $f/6.8$, $f/11$, and $f/22$. The finder, of the direct-vision type, pushes out from the front and forms part of the latter when returned before closing the camera. The eye-piece at the back of the instrument magnifies the image in the finder.

Perhaps the most novel feature of the camera is the focussing adjustment, which is done by racking forward the framework on which the supporting springs of the front are attached. The movement is not great, and, as Messrs. Goerz rightly point out, for the great majority of work it is best to keep the focus at, say, six yards, when almost everything else will be in focus with a lens of such short focal length. They indicate this "best" point in red on the focussing disc, but provide a scale for objects from three yards to infinity. The whole apparatus is, as we have said, beautifully made, and has the mechanical precision which is absolutely essential in apparatus of this kind. It is sold, complete with six single metal slides, a hooded focussing screen, and soft leather case, for £10. An extra set of six slides, complete in case, costs £1.

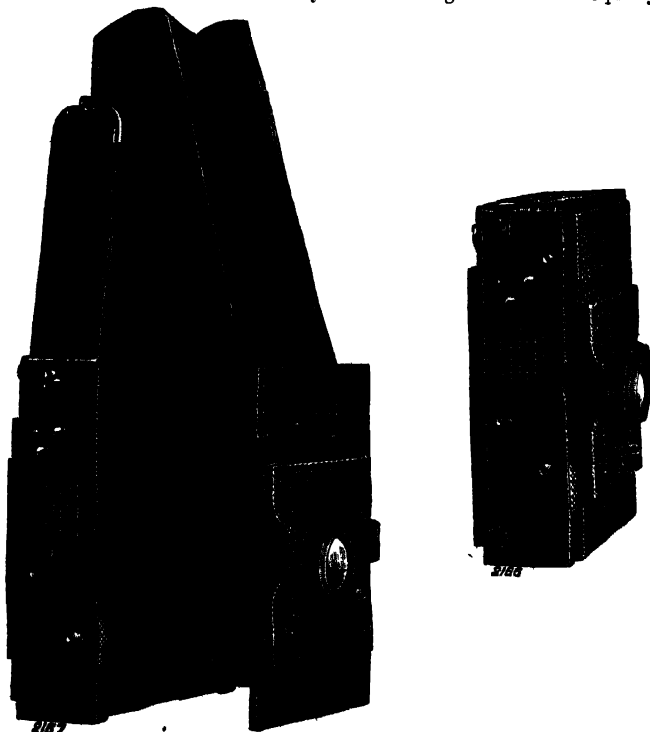
Messrs. Goerz supply a special enlarging apparatus for the "Tenax" negatives, consisting of camera (carrying paper up to 7 x 5 ins.), one dark slide, condenser, and paraffin lamp, for £4 10s.; the lens of the "Tenax" itself being used as the objective.

THE HOUGHTON FOLDING REFLEX CAMERA.

(Made by Houghtons, Limited, 88 and 89, High Holborn, London, W.C.)

A reflex camera which folds up to the bulk of scarcely any more than the usual focal-plane folding camera is certainly a step forward in cameras of this class, upon the introduction of which the makers are to be congratulated. In build the camera follows the construction of the folding focal-plane, being extended on a pair of struts. The front, however, is the full size of the back, and carries a moving lens panel, which, actuated by rack and pinion, gives a rise of over one inch. This panel carries the lens in a focussing mount, the adjustment for focus being provided in this way. On opening the camera the only movement necessary to get it ready for action is to unfold the hood and attach it to the two light metal leather-covered struts, one of which is shown above the winding key in the drawing, and to turn the lever above the winding key into a vertical position. This latter movement depresses the mirror into the set position. In closing the camera the order of these two operations is reversed, except that the strut support of the hood, on being sprung into place, automatically actuates the adjustment, by which the mirror is allowed to fall in the focal-plane, and so permits of the camera being closed. If this does not take place a safety locking lever prevents the struts from being released, and the mirror must be turned into place before the camera can be shut. As regards the shutter, the camera is fitted with a new pattern, which has a very simple adjustment of slit, and, moreover, permits of time

exposures being given not only by the usual method but by "bulb," the exposure being continued during pressure on the release. This latter feature, of very frequent advantage when exposures of a second or two have to be given, is offered by very few focal-plane shutters. The camera has a very neat rotating back and an equally



convenient locking device for preventing accidental removal of the dark-slide. Complete with three double slides, which are of the flexible blind pattern without projections, the price is £18 without lens, £21 with "Ensign" lens, and £24 10s. fitted with Goerz anastigmat.

THE "UNIVERSAL" SCREEN HOLDER.

(Sold by Charles Zimmermann and Co., Limited, 9 and 10, St. Mary-at-Hill London, E.C.)

This apparatus provides the means of using circular glass light-filters of certain given diameters on lens-hoods of different sizes. The drawing shows the front of the holder, there being visible

through the light-filter the three clamps which, when actuated by the wing-screw, fix the whole to the lens hood. The light-filters are simply dropped into the circular aperture, where they rest on a rebate, and are kept in place by a ring which is instantly attached. The holder is made in three sizes, fitting lenses from a half inch

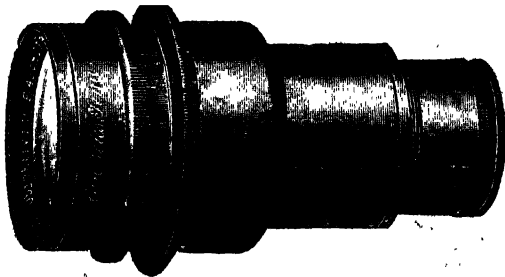


diameter up to $1\frac{1}{2}$, 2, or $2\frac{3}{4}$ inches, the price, complete with three optically worked screens in leatherette case, being 15s., 20s., and 30s. It should be a most convenient accessory for those who have to do orthochromatic work with a variety of lenses.

THE ZEISS SPECIAL TELE-OBJECTIVE.

(Made by Carl Zeiss, Jena, and 29, Margaret Street, London, W.)

This is a further improvement of the Zeiss tele-objective of about three years ago, which worked at $f/14$. Drs. Rudolph and Wandersleb have now produced an objective of the same class, but with



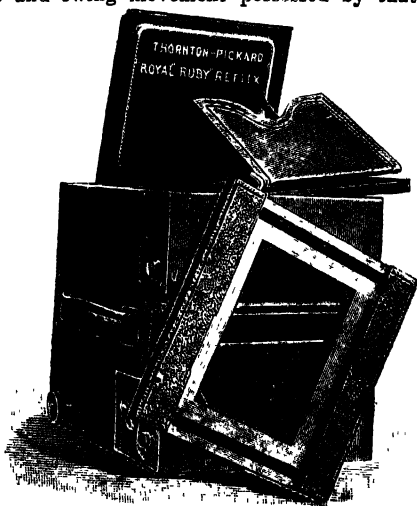
the large working aperture of $f/10$. This has been done by employing the positive element not as a photographic objective alone, but by correcting the whole system together and thus obtaining a system of definite focal length requiring a definite camera extension. In other words, the telephoto is of fixed instead of variable

focal length, and the advantage of this will be evident when it is stated that a camera extension of six inches suffices for the use of an equivalent focal length of 18 inches. The lens covers a quarter-plate or 5×4 at full aperture with first-rate definition. The use of a smaller stop improves the definition a little at the margins, but the area covered is then smaller—a circle of about $5\frac{1}{4}$ inches diameter. The lens can be fitted to cameras with a flange of $1\frac{1}{8}$ inches inner diameter, and is employed just like an ordinary positive lens mounted in a focussing jacket, a calibrated scale allowing for the focussing of objects from infinity to 8 feet distant. The lens projects scarcely more than an inch behind its flange, the portion before the flange being $3\frac{3}{4}$ inches in length. The outside diameter of the hood is almost exactly $2\frac{1}{4}$ inches, and the price of the complete objective, which should be extremely useful for hand-cameras, and particularly for reflex camera work, is £10.

THE "ROYAL RUBY" REFLEX CAMERA.

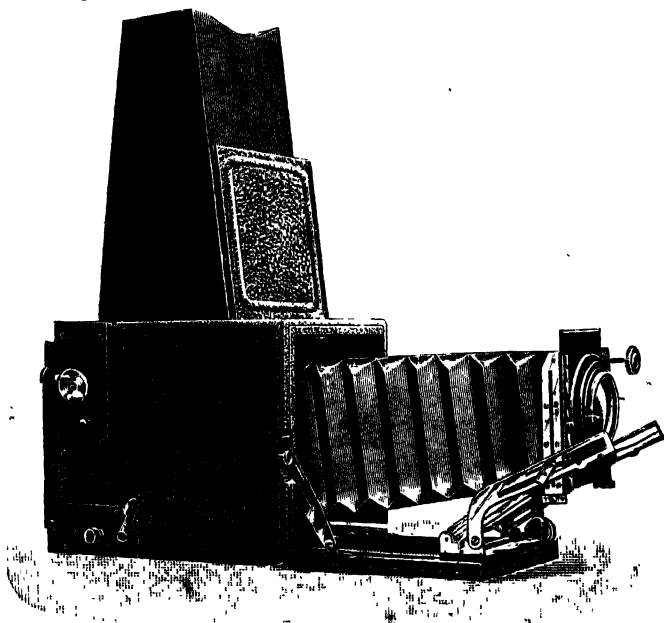
(Made by the Thornton-Pickard Manufacturing Co., Ltd., Altrincham.)

This camera has the unique feature that the front is that of the "Royal Ruby" camera, and therefore possesses the very great rise of front and swing movement possessed by that instrument.



The double action of the front is retained—namely, the one movement in the brass struts and a further rack and pinion adjustment of the lens panel. When carrying the camera the front is entirely enclosed by the hinged door, save for a central aperture which allows of the camera being used without opening the front in the case of distant objects. The work of bringing the front out is, however, only a matter of a second or two, the racks on the base-board forming a continuous line with those inside the camera. The

focussing hood is immediately detachable (in fact, it can be removed altogether) for examination of the ground glass and mirror. The latter is of surface silvered plate, and is swung in a way which allows of its movement within a small space, thus providing room for the bellows, which in the case of this camera extend to 15 ins. altogether. The shutter is of the two-slit pattern, one the full width of the plate and used for time exposures or instantaneous up to about 1/40 second, and the other adjustable in width for the most rapid work. The alteration of the slit is made very con-



veniently, and there is an automatic locking arrangement whereby it is necessary to set the mirror before the shutter blind can be wound up for exposure. This arrangement can be put out of action when necessary simply by moving a small stud next the winding-key. The camera has rotating back, and is provided with a hooded focussing screen for direct work when necessary. Its whole construction and design is quite of the high standard of the Thornton-Pickard Co., and, considering the very great range of movements, the price of £10 10s., without lens, but with three double plate-holders of the pull-out pattern, is most moderate. With three book-form slides instead of the previous pattern the price is £11. The Ross "Homocentric" Series III. can be fitted of 5½ ins. focal length, but other standard anastigmats require to be at least 6 ins.

focal length. One other point should not be omitted, and that is that the shutter release takes the form of a stud fixed to the front of the camera, so that the pressure is a direct thrust against the body of the photographer—that is to say, the best possible from the point of view of avoiding vibration.

It should also be mentioned that, with the mirror put out of action, the camera may be used like any other hand or stand focusing camera. Moreover, when used on a tripod, may be employed for all the many descriptions of work for which its long extension and great rise of front peculiarly fit it.

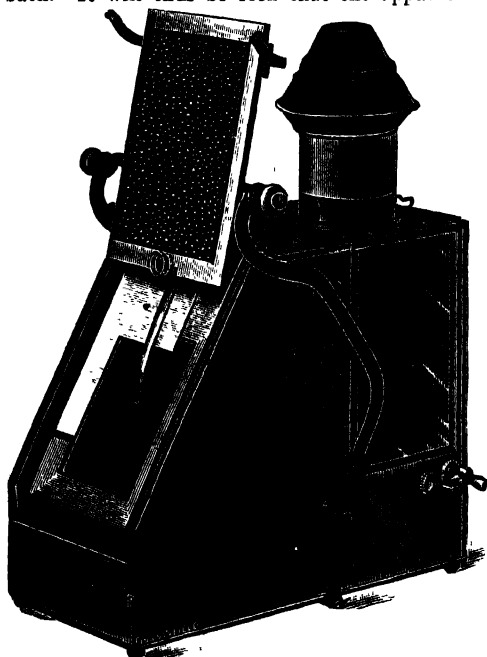
In addition to the above instrument, the Thornton-Pickard Company are also issuing a "Ruby" reflex, which in general design is similar to the "Royal Ruby," but has not the universal swinging and rising front of the latter. The quarter-plate size of this instrument is issued complete with focal-plane shutter and three double slides, but without lens, at £6 10s.; or with Beck symmetrical R.R. lens at £7.

THE RAPID TABLE BROMIDE PRINTING MACHINE.

(Sold by Jonathan Fallowfield, 146, Chancery Cross Road, London, W.)

In this apparatus the photographer is provided with a most expeditious means of printing from negatives of half-plate size and under, and that in an apparatus which requires only table room and is operated solely by the worker's two hands. In fact, for the actual movements of the apparatus itself only one hand is needed, the other serving to feed in the sensitive cards or papers and control their removal when exposed. The printer consists of a chamber measuring $17\frac{1}{2} \times 8$ ins. at its base and standing 22 ins. high to the top of the chimney. It is fitted in one pattern, with both an oil lamp and an adjustment for gas, the latter being mounted on a joint which allows of the gas burner occupying a central position. Access to this portion of the apparatus is by means of a metal door in the back and a window on each side, which is fitted with ruby glass, and thus enables the lamp to serve also for the illumination of the developing table. The front of the apparatus contains a framework made to carry a half-plate negative, or a carrier in which smaller negatives may be held. This framework is backed by a series of grooves into which a vignetter may be inserted in order to produce vignette effects, when necessary. The negative being placed in the frame, the exact subject which it may be desired to include in the print is selected by removing the right-angled metal piece seen in the drawing, which, after adjustment, is fixed by a set screw, and thus forms a stop for the card or paper, the latter being thus quickly placed in register upon the negative. A light spring, also seen in the drawing, serves to hold the card in position when the pressure back is fully out, but on this latter being thrown completely up the pressure is released, and the paper falls by its own weight into a suitable receptacle placed to receive it. The operation of printing consists simply in sliding the card or paper under the spring and up to the stop, pressing down the wooden knobs of the handle to the full, at which moment the exposure commences owing to the drop of the orange glass screening

the light. Exposure is terminated by raising the handle, and, as before stated, the paper released by completely throwing up the pressure back. It will thus be seen that the apparatus allows of



very rapid taking off of prints from the negative, whilst its working parts are reduced to so few that one may reasonably expect its working for a long period without getting out of order. The price of the printer, either for gas and oil or for electric light, is 52s. 6d.

THE "TELLA" REFLEX CAMERA.

(Sold by the Tella Camera Co., 68, High Holborn, London, W.C.)

The "Tella" reflex has been specially designed to reduce both size and weight, and the success which has attended these efforts should be sufficiently obvious when we say that the instrument before us, which takes a picture of quarter-plate size, measures 5 x 6 x 5 in., although it is an apparatus of the double-extension type, giving an extension in all of 12 in. As regards weight, the camera, together with the lens, weighs 2½ lb., and when carried in the hand makes its weight felt less than a good many cameras even of the ordinary pattern. The worker, therefore, who may have been deterred from availing himself of the reflex advantages would be well advised to inspect the "Tella" camera before taking it for granted that the objections of size and weight are insuperable in his case.

As regards the movements of the camera itself, we would first point out that it possesses the great advantage of a rise of front of $1\frac{1}{2}$ in., equal to one-third the vertical height of the quarter-plate. The extension is obtained, first of all, by direct racking out of the front, which gives a distance from lens to plate of $10\frac{1}{2}$ in.; the additional

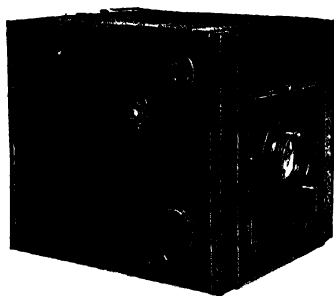


Fig. 1.

inch and a-half is then obtained simply by removing and reversing the lens panel, which carries a collar just over 1 in. deep. On the panel being reversed this collar projects, and the lens being then screwed into the front of it the total long extension is obtained, as shown in Fig. 2.

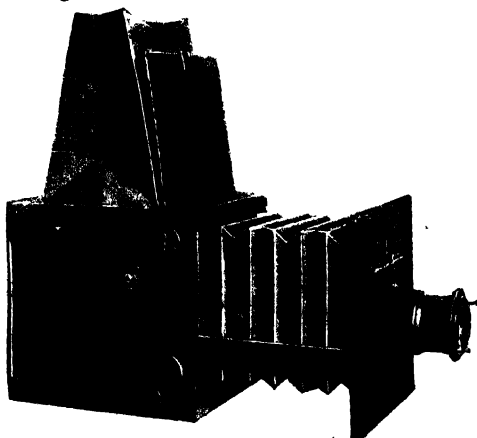


Fig. 2.

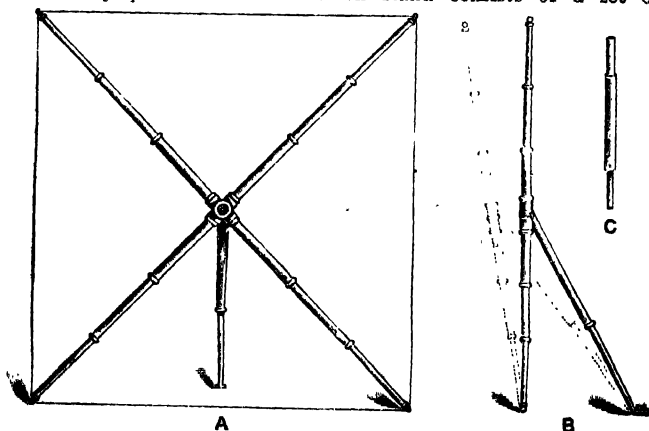
The panel is leather-covered on both sides, so that at full extension, as well as in the normal position, the finished appearance of the camera is preserved. The focussing rack and pinion are placed

on the right of the instrument and the shutter release on the left, the latter being the only adjustment on that side of the camera, a plan which prevents any accidental mistake, even by the beginner. The adjustments of mirror and shutter are very nicely contrived. The mirror itself works wonderfully lightly, and, as we have found in our own experience, with freedom from vibration. The shutter is kept at constant tension, and the speeds (1 second to 1-1,000th) obtained by altering the width of the slit, which is done by winding the shutter until the bottom aperture of the blind is level with the lower side of the reversing back; the shutter winding-key, B in the drawing, is then pressed in and turned until the desired shutter speed is obtained as shown in an indicator, G, on the other side of the camera. The shutter also quickly provides for time exposures. The reversing back is made of the detachable pattern, and has one good feature which should not be overlooked, namely, that in the position for vertical pictures the dark-slide is inserted from the bottom of the camera so that the mouth of the pull-out dark-slide is shielded by the camera itself from direct sunlight, the slide being, in fact, upside down while in readiness for exposure in the camera. This is but one point which shows the care taken in the designing of the instrument. The camera altogether impresses us as a suitable instrument for tourist, or indeed general, work. Its price is ten guineas with six single dark-slides in quarter-plate size, or £14 15s. with Ross "Homocentric," Series III., *f*/6.3. A tropical model of the camera, built of polished teak and brass-bound and screwed at every joint, is made for climates where extremes of heat and damp have to be reckoned for. This camera only with six slides is sold for £15. The camera is also made in $3\frac{1}{2} \times 2\frac{1}{2}$ in. size.

THE MERITO TELESCOPIC TILTING SCREEN STAND.

(Made by W. L. Parkinson, Limited, 5, Commutation Row, Liverpool.)

This very portable lantern screen stand consists of a set of

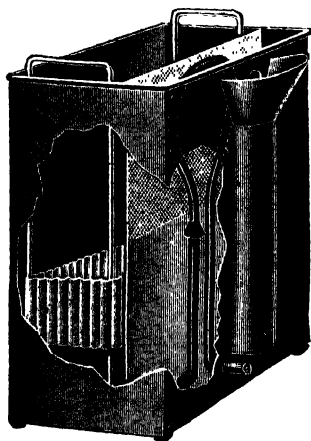


telescopic seamless steel tubes, which, with the aid of a centre four-way piece and a bracing cord, form a screen for a 12-ft. sheet at once, strong and rigid, and possessing the advantage that the screen can be tilted. The stand requires but one screw to affix it to the platform, where it stands firmly without projections, such as a lecturer might stumble against in the dark. The whole outfit packs into a waterproof canvas case 3 ft. 6 ins. x 4 ins. x 4 ins., leaving room for a 12-ft. sheet as well, a triumph of compactness upon which the makers are to be congratulated, and in verifying which and the above claims we have ourselves been most satisfied. The price, with case, but without sheet, is £3 15s; but a cheaper pattern is made, with tubes of iron in place of the seamless steel, at £2 15s. 12-ft. square, best quality calico screen, with one seam, £1 2s. 6d.

THE "SCIENTIFIC" PLATE WASHER.

(Sold by W. Butcher and Sons, Limited, Camera House, Farringdon Avenue London, E.C.)

An excellently designed washer, which is certainly a great improvement upon the usual type as regards ensuring a constant change of water in which the plates soak, is shown in the drawing, from which it will be seen that the washer consists of a tank, in which is a division, solid half-way from the bottom, and perforated



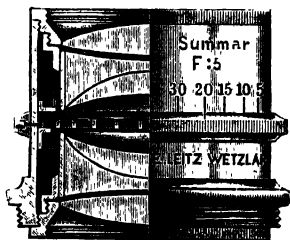
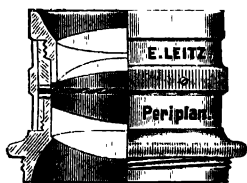
in the upper part. A syphon communicates with the main portion of the tank in which the plates are placed, and is provided with an air-hole, so that its action, which commences when the water covers the top of the bend, is arrested when the water has fallen to the height of the inverted cone, seen half-way up the syphon tube. Thus the action of the washer is always to remove the lower portion of the water standing in the tank, and to replace it quickly

by a supply of clean water reaching it through the perforated division. The washer is, therefore, most economical of water, and most effective in its treatment of the plates. It is made to take both quarter-plates and half-plates, at a price of 3s. 9d.

THE "SUMMAR" AND "PERIPLAN" LENSES.

(Made by Ernst Leitz, Wetzlar, and 9, Oxford Street, London.)

These lenses mark the entrance into the photographic objective trade in England of the eminent firm of Leitz, a firm whose optical work in microscopic lenses has long drawn high eulogies from experts. Messrs. Leitz, if we may judge from the few lenses we have examined, are to obtain similar commendation from photographers. The "Summar" lens, Series II., is a symmetrical anastigmat of a very high degree of correction, and working at the large apertures of $f/5$ to $f/6$. The one we have tried is No. 6 of 150 mm., or 6 ins. focal length, $f/6$ aperture, and intended to cover 12 x 15 centimetres. This it does readily, and, in fact, it can be used over a much larger plate. All its corrections seem to be of a very high order, and the single combination works well at an aperture of about $f/11$. The field of the doublet is practically flat, and a small point of light can be sharply focussed in any part of the plate, even in a half-plate camera. This should be an ideal lens for the ordinary hand camera of the non-reflex variety, for when we depend on focussing by scale a lens of much greater rapidity than $f/6$ often leads to trouble, owing to its want of depth. The price of this No. 6 lens is £4 10s. in ordinary mount. A quarter-plate lens of 5½ in. focus belonging to the "Summar" Series II. has the yet larger aperture of $f/5$, and costs the same as the 6 in. of $f/6$ aperture. Another 6 in. lens of $f/5$ aperture is also listed, at £5.



The "Periplan" is an unsymmetrical lens of full aperture of $f/7.7$, and, though a very much cheaper lens than the "Summar," its performance at full aperture leaves nothing to be desired. Even though the back combination consists only of two cemented lenses, yet this at $f/16$ gives excellent results. The lens tested is No. 3 of 150 mm., or 6 ins., focal length, and therefore it can be well compared with the "Summar" of the same focal length. Its covering power is almost exactly the same, and its performance at $f/7.7$ is practically equivalent to that of the "Summar" at $f/6$.

The price is only £3, as against £4 10s., the difference being, of course, due to the smaller rapidity, but, still, an $f/7.7$ lens is not a slow one, and perhaps this aperture is the most generally useful of all. We can strongly recommend the "Periplan" to anyone requiring a cheap $f/8$ lens— $f/7.7$ and $f/8$ are, of course, practically the same thing. A 5¼-in. lens only costs 50s., and few lenses of such good quality are obtainable at such a price.

THE BUSCH "BIS-TELAR" SERIES F/7.

(Sold by Emil Busch Optical Co., 35, Charles Street, Hatton Garden, London, E.C.)

The original Bis-Telar working at full aperture of $f/9$ is well known to our readers, and its usefulness as a long focus lens, requiring only a very short camera extension, is fully appreciated. The new series works at the very useful aperture of $f/7$, and therefore is much better adapted than the old one to hand camera work, so that we can fairly class it as a rapid telephoto lens. The one submitted to us is No. 2 of Series 2, with a focal length of $10\frac{1}{2}$ ins. and a back focus of only about $5\frac{1}{2}$ ins. It is listed to cover a quarter-plate, and it appears to do this—and more—with excellent definition at full aperture. It has often been claimed that 10 ins. is the ideal focal length for a quarter-plate, but few quarter-plate cameras will extend sufficiently to take such a lens. The "Bis-Telar" is, however, suited to any quarter-plate camera by reason of the short extension required, and the small bulk which is no greater than that of an eight inch R.R. lens. The price of the No. 2 is £3 in iris mount, £4 in focussing mount, and £5 8s. in Koilos shutter, the other lenses of the series being equally moderate in cost. We may note that while the old $f/9$ series only included lenses from 7 to 14 ins. focal length, the new $f/7$ series includes lenses varying from 8 to 22 ins., the camera extension in each case being about half an inch more than half the focal length.

THE "COUNTA" EXPOSURE REGISTER.

(Sold by J. Mayes, 55, Red Lion Street, Clerkenwell, London, E.C.)

This useful device for the automatic record of exposures takes the form of a small accessory one inch in diameter, which is attached to the camera front by means of a metal plate on to which it slides. The "Counta" itself fits on to this supporting back plate. The "Counta" registers exposures up to a total of twelve, a small projection being connected to the lever release of the shutter so that the act of exposure moves the "Counta" forward one division. In its normal position the "Counta" is locked so that the number cannot be accidentally altered, but if it be desired to turn the register forward an unlocking lever is moved, and the milled head then allows of the register disc being turned forward through any number of divisions. The little apparatus is most strongly made, and should prove most reliable in use. Its price is 5s.

THE "PYKET" SELF-CAPPING FOCAL-PLANE SHUTTER.

Made by F. Whitehead and Co., Picket's Street Works, Balham, London, S.W.)

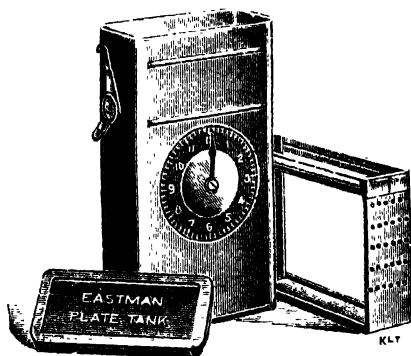
For this new pattern of focal-plane shutter it is claimed by the makers that the mechanism cannot be put out of order, and, so far as our attempts at derangement have gone, we must certainly say that the makers' claim is justified. But even if the shutter needed more than the usual care in manipulation the movements which it gives should compensate the user. The shutter provides time and instantaneous exposures; all speeds are adjustable while the shutter is set; the full aperture can be uncovered for focussing again while the shutter remains set for an instantaneous exposure; and, lastly, the blind can be used, by an up-and-down movement, as a foreground shutter or a silent studio shutter. These adjustments are obtained by means of two separate blinds. The winding key being wound to the full sets the shutter at T. On release the blind opens to the full width, and remains open as long as the release is kept pressed, this "bulb" form of exposure being ended by blind No. 2 flying up from the lower roller. By winding the key short of T the blind may be arrested at any of several points at which the aperture is narrower, or if the key be fully wound it can be pressed in towards the body of the shutter, and the indicator turned back to the required width of aperture. Five aperture widths, adjustable, as we have said, while the shutter is set, in conjunction with five tension springs, give a range of exposures in the 4 x 4 shutter of from 1-15 to 1-1000. For focussing the only necessary movement is to wind the blind open by the smaller key at the base of the shutter. This key is made grooved, so that by winding a short length of twine upon it the blind can be instantly lowered and as quickly made to recover the plate. The speed at which it travels downwards is, however, quite within the user's control, so that exposure can be graduated over the plate as thought well. Also, the movement allows of the "Pyket" shutter serving admirably as a silent invisible studio shutter. It should be mentioned that the shutter is self-capping, and the plate before and after instantaneous exposures is covered by two thicknesses of blind. After a time exposure it is covered by but one thickness, but an additional thickness may be caused to fall down simply by pressing in and touching the winding key. The whole mechanism and design of the shutter appears to us excellent in every way. It is made in the quarter-plate size—that is, square, 4 x 4 ins., for about £3 3s. When fitted to a reflex camera, as it is to the "Beaufort" (noticed elsewhere), it is made with a quick wind, but this latter feature is not given it in the ordinary pattern on account of the increased thickness necessitated by a large winding disc.

THE "EASTMAN" PLATE-DEVELOPING TANK.

(Made by Kodak, Limited, Clerkenwell Road, London, E.C.)

The "Eastman" tank possesses several important qualifications for the duty of holding plates for vertical development. It has strength and lightness. Its substance of nickelled metal fits it to withstand long usage. It provides for the rapid insertion of the

plates into their grooves; if necessary, in total darkness—a facility which, so far as we know, is not provided in any similar tank. This is done by the use of a loading block of novel design. This block consists of a stout framework, in which the plate-rack is temporarily fastened (for loading) by means of a clip. Across the aperture of the framework moves a board, in which is a slit wide enough to take the pair of plates, which go into each of the six grooves of the tank. The slit registers with the groove of the tank, and the pair of plates have only to be slipped into it to pass into the rack. The slit is narrowed at the ends so that the surfaces of the plates are not rubbed in their passage. The slit is then moved on to a position over the next groove of the rack. This is done by pressure on one of two metal studs, and in this way all six grooves are quickly charged with plates. We can testify to the advantage of this plan in practice. No getting the plates across their proper grooves. In ordinary work it is a comfort, and for panchromatic plates practically indispensable.



The plate-rack is well perforated, and provides for proper circulation of the developer. The tank is fitted with a light-tight lid, which is held securely down by a special type of clamp, and lastly, a dial and movable pointer are affixed for use in removing the plates from the developer at the expiration of a given time.

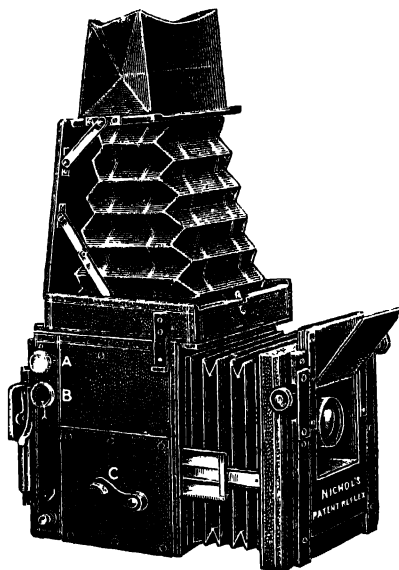
The tank is made in two sizes, for 5×4 and 7×5 plates respectively. The former (12s. 6d.) is provided with an adapter for quarter-plates. The latter (16s. 6d.) is similarly provided with an adapter for half and $6\frac{1}{2} \times 4\frac{1}{4}$ plates.

THE "BEAUFORT" REFLEX CAMERA.

(Made by Turner, Son, and Hope, 88, Beaufort Street, Liverpool.)

This reflector camera, manufactured by an old-established firm of camera makers, is supplied by them wholesale only, and therefore inquiries for the "Beaufort" must be addressed to retail dealers in photographic apparatus. In the quarter-plate model which we have had under trial the outside dimensions of the camera are

6 x 6½ x 7½ ins., which is less than those of other reflector cameras which will not do so much as the "Beaufort." The hood, as shown in the drawing, is held erect by the strutted cover-board of the camera; it is 8 ins. in height, and gives a clear view of the focussing screen. It is, moreover, quickly collapsible, and, further, is instantly detached at its base from the camera, affording free access to the mirror for dusting and for wiping the ground glass. The mirror itself, when viewed from the bared cover of the camera, will be seen to have a zig-zag or shrinking movement when passing from the "down" to the "up" position, and *vice versa*—that is to say, on its first release it moves slightly backwards, and so



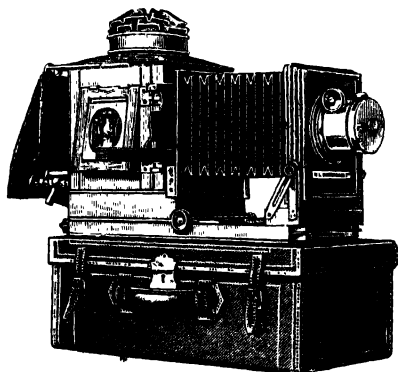
"dodges" the lens mount. This movement, it is scarcely necessary to point out, has the merit of permitting a lens of extra short focus to be used, in the case of the "Beaufort" before us, one requiring a distance of 4½ ins. only from back of mount to plate. The mirror-setting lever serves also for the shutter release, and, unless specially adjusted, it automatically falls back on releasing the setting lever. The shutter is self-capping, so that the plate can never be exposed accidentally. In the matter of extension the camera is well provided; it racks out on its two struts to 9½ ins., and then pulls out (from plate to camera front) to a total extension of 12½ ins. As the lens is recessed about 1½ ins., a reduction of this latter length must be made, but even then the extension is more than enough for the half of a 5½-in. lens, and there are also

means for affixing an auxiliary lens panel an inch forward. At both short and long extension the rise of front (nearly 1 in., and by rack and pinion) is available. The extension at both full and moved half-way is one of the most rigid we have handled. The camera has reversing back, lens shade, and other movements; but we have said enough to show that in the "Beaufort" the prospective purchaser of a reflex has a most compact, efficient, and strongly made instrument for the comparatively small sum of £9 9s., with three double slides, but without lens.

THE "PARKINSON" FOLDING OPTICAL LANTERN.

(Made by W. J. Parkinson, Limited, 5, Commutation Row, Liverpool.)

A fully-equipped optical lantern, which packs within a dress-suit case measuring $18\frac{1}{2} \times 10\frac{1}{2} \times 6\frac{1}{2}$ ins., and even then leaves room for a 12-ft. lantern screen, is what Messrs. Parkinson have accomplished in this apparatus. They have achieved this result without any sacrifice of the efficiency of the instrument by an ingenious construction, by which the side and front walls of the lantern body are hinged so as to fold on themselves, the objective front, with the objective still in position, also folding on to the baseboard extension, and the whole apparatus when thus closed for carrying representing



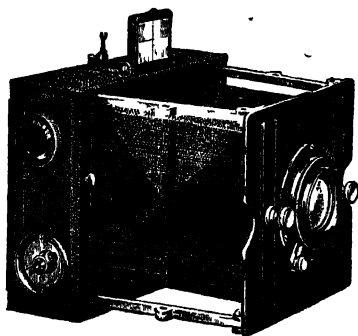
a block with scarcely any interspaces unoccupied. The work, however, of erecting the apparatus for use is a matter only of a few seconds. The lantern body is 8 ins. in width, and can accommodate a full-size dir-e-jet. It is fitted with a Russian iron lining, and one also of asbestos, and has one specially excellent feature—namely, the $3\frac{1}{4} \times 3\frac{1}{4}$ ground-glass panel in the door, by which the slide can be comfortably examined before being placed in the lantern. The stage is open at the top, and accommodates the very convenient "Parkinson" carrier, in which the slides are inserted and removed from the one side of the lantern. Focussing is by rack and pinion extension of the baseboard, and also by the rack and pinion on the

objective, which is provided with slit for tinting-glasses and the shutter-flasher. Complete with a real leather case, with lock and key, the price of the outfit is £7, or with a superior case of solid leather hide £8.

THE VOIGTLÄNDER FOCAL-PLANE CAMERA.

(Made by Voigtlander and Sohn, 12, Charterhouse Street, London, E.C.)

To this instrument of the still popular folding focal-plane type the makers have fitted a new pattern of focal-plane shutter, which reduces to almost the acme of simplicity the adjustment necessary for this type of shutter. The shutter is wound by the large milled screw seen in the drawing, about one half-turn sufficing to set the blind. This latter is of the self-capping variety, the plate being kept covered except at the moment of exposure. The adjustment of speeds is made most easily by the disc and pointer seen in the drawing below the winding key. To set the shutter for time, all that is necessary is to point the arrow on the central disc to the

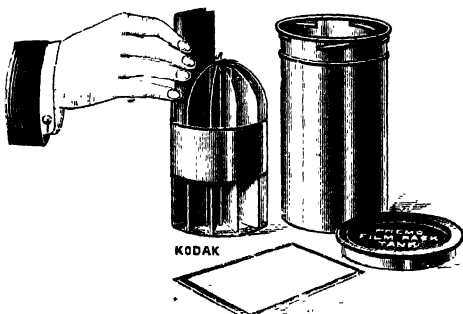


letter Z, when pressure on the release opens the shutter and a second pressure closes it. On turning the arrow to point to M, instantaneous exposures are given on pressure of the release. These latter are altered simply by grasping the central spindle of the lower disc and turning it to any position on the scale of apertures marked below it, the width of these apertures being seen through a small hole in the circular plate. Both this adjustment and that of time to instantaneous, and *vice versa*, are made while the shutter is set, and are the work of an instant only. The working of the blind is light in the extreme, and the shutter is certainly as convenient a form of the focal-plane as can be imagined. The price of the camera with this new shutter, and with the "Heliar" $f/4.5$ of 15 cm. focal length, and three double dark-slides, is £14 10s., made in metal. A similar instrument, of half-plate size, made in wood, is sold at £17 complete, with "Collinear" Series II., of 20 cm. focal length, working at $f/5.4$, and with three double slides.

THE "PREMO" FILM PACK DEVELOPING TANK.

(Made by Kodak, Limited, Clerkenwell Road, London, E.C.)

This tank developer accommodates twelve films such as those used in the "Premo" film pack, which are placed bent, as shown in the illustration, each in a separate division of the beehive-shaped

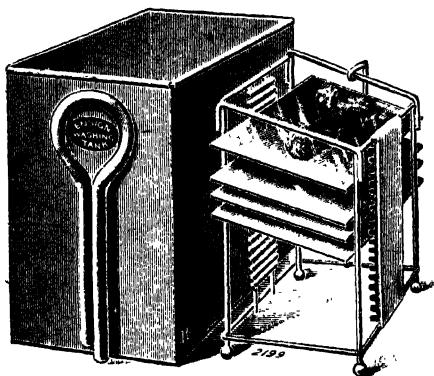


rack. Here they get even exposure to the developer, since the tank is provided with a water-tight lid which allows of its being inverted at intervals. The tank and rack are strongly made in nickelled metal, and cost in quarter-plate, postcard, or 5 x 4 size (taking twelve films), 16s. ; or to take six 7 x 5 films, 18s. 6d.

"ENSIGN" FILM-DOWN WASHING TANK.

(Made by Houghtons, Limited, 88 and 89, High Holborn, London, W.C.)

Made of stout zinc, this tank is of solid construction. The rack



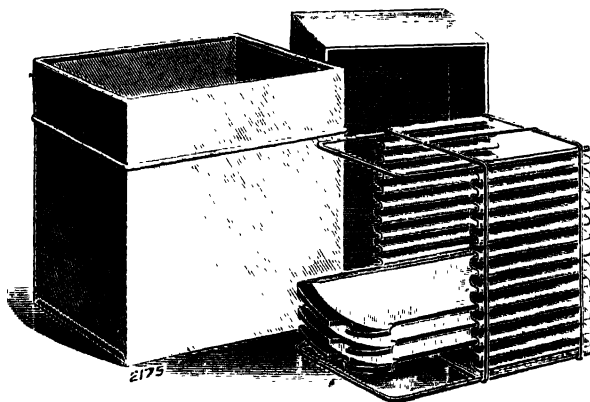
is a novel part of it, the plates being inserted into it in the ordinary

vertical way, but the rack is then placed in the tank so that the film side of the plates is downwards, thus facilitating the removal of the hypo. The rack holds eighteen plates, and costs in quarter-plate size 3s. ; in 5 x 4, 3s. 6d. ; and in half-plate, 4s. 6d.

"ENSIGN" CUT FILM DEVELOPING TANK

(Made by Houghtons, Limited, 88 and 89, High Holborn, London, W.C.)

A very nicely made brass tank for development of cut films or film-pack exposures is issued by Messrs. Houghtons at a price of 13s. 6d., complete with rack and twelve patent sheaths. These latter are made of curved shape, so that the spring of the film itself



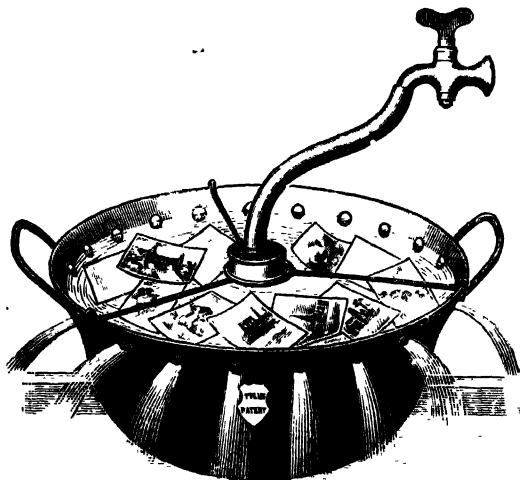
keeps the latter firmly in position. Moreover, the rack is built square, so that if a few films only are to be developed, only enough solution to, say, half fill the tank need be used, the rack being inserted in the position shown in the drawing. The full capacity of the tank is 40 ozs.

THE "NULLI SECUNDUS" PLATE WASHER.

(Sold by W. Tylar, Limited, 41, High Street, Aston, Birmingham.)

A great recommendation of this apparatus is in the first place the fact that by detaching the sprayer a number of bowls can be stacked together, and can thus be distributed through the trade at very much smaller demands on the space of a dealer for storage purposes. The washer provides for the lively circulation of the prints, the surplus water escaping by holes round the upper edge

of the basin. The bowls are stamped from one piece of metal, and are well japanned inside and out, and provided with a pair of



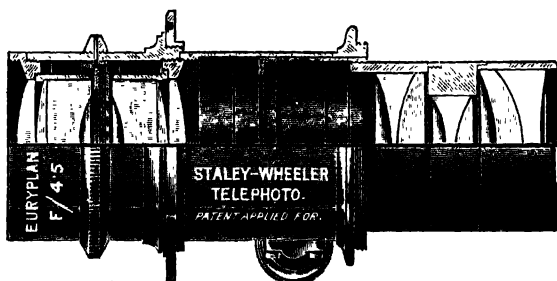
stout handles. The washer is made in two sizes, No. 1, 4s. 6d. ; and No. 2, 7s. 6d.

THE STALEY-WHEELER CONVERTIBLE TELEPHOTO LENS.

(Made by A. E. Staley and Co., 19-20, Tavies Inn, Holborn Circus, London, E.C.)

This new instrument, the result of the work of Captain Owen Wheeler, marks an important step forward in practical telephoto work, inasmuch as it allows very highly magnified photographs to be obtained with a normal camera extension. This advance is due to the production of a tele-negative lens of extremely short focus, as short as 12 millimetres, or a little over $\frac{1}{2}$ in. Moreover, this short focus negative attachment is made up of three separate negative lenses, so that the Staley-Wheeler lens possesses the double advantage of giving the high magnifications of 20 to 30 (without undue camera extension), and at the same time permitting of lesser magnification being obtained by the use of one or two only of the separate negative lenses. The gain from a practical point of view will be understood when it is said that the Staley-Wheeler lens contains within itself a battery of lenses of focal length from 7 ins. to 18 ft. An object which, when taken with the first, would appear only as a speck on the focussing screen of area about 1.5×1.7 of an inch, will, when photographed by the full-power telephoto, completely fill a half-plate, and this, as we have said, with a camera extension of 14 ins.

Considering the facilities which it thus affords, the weight and size of the lens are not excessive. The lens consists of a brass or aluminium tube 4 ins. in length, to the front of which the positive lens is screwed, whilst to the rear an auxiliary tube, $1\frac{1}{2}$ in. in length, is likewise screwed. The intermediary tube carries an inner tube which is actuated by a rack and pinion, and serves to move the positive in relation to the negative, the separation between the two being indicated by a millimetre scale engraved on the inner tube. The component lenses of the negative attachment are mounted in cells which fit in the rear tube, and are kept in place therein by a spring ring. Inclusive of the positive lens, this apparatus projects only 7 ins. from the flange, which is mounted on the camera



front, though it must be stated that a further important part of the outfit must be added—namely, a lens hood, which, as Captain Wheeler has shown, is an absolute essential in obtaining brilliant telephoto negatives, its function being to prevent internal reflections in the optical system. The double-tube hood, supplied for this purpose, measures, when extended, 9 ins., being closed to half this length for carrying. The positive lens suitable for the telephoto is one of about 7 ins. focal length and preferably of large aperture. Messrs. Staley recommend their Euryplan of $f/4.5$ or $f/5.6$ aperture, but the lens can be adapted to any anastigmat of good quality. With a 7 in. lens the following are the magnifications obtainable by the use of one or more of the negative components of the lens:—

- A C B gives about 30 magnifications.
- B C gives about 23 magnifications.
- A C gives about 19 magnifications.
- C gives about 14 magnifications.
- A B gives about 13 magnifications.
- B gives about 8 magnifications.
- A gives about 6 magnifications.

The focal lengths of A, B, and C are respectively 67, 50, and 30 mm.

Our own use of the lens and a regular acquaintance with the results obtained by Captain Wheeler convince us as to the really excellent results produced. The sharpness of negatives made at

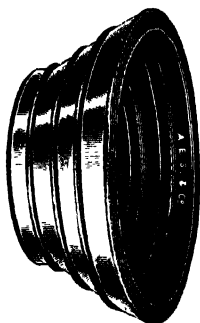
the great magnification of 20 diameters is remarkable, and at magnifications somewhat less trying to all the conditions of rigidity of apparatus, freedom from air currents, etc., which militate against telephoto work, the negatives might easily be mistaken for those taken direct. The case for the use of a hood as a means of making brilliant negatives has been fully proved by Captain Wheeler's work.

The price of the Staley-Wheeler telephoto, suitable for positives from $6\frac{1}{2}$ to $8\frac{1}{2}$ ins. is £5 5s.; for positives from $9\frac{1}{2}$ to 11 ins., £5 5s. The respective hoods cost 10s. 6d. and 12s. 6d.

THE STALEY-WHEELER COLLAPSIBLE LENS-HOOD.

(Made by A. E. Staley and Co., 19, Tavies Inn, Holborn Circus, London, E.C., England.)

The lens-hood, which for some years past has shown a tendency to disappear from the mounting of photographic lenses, has recently revived, owing to the necessity of shading the lens from direct light in the case of anastigmats which possess large aperture and

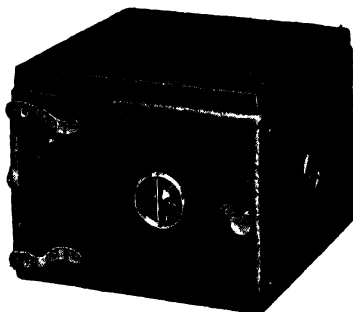


are usually of the air-space type of construction. A hood which actually cuts off light from the surface of the lens is a better method than the use of diaphragms in the camera, which aim to cut off the light transmitted by the lens, and for this reason satisfaction should be felt that Messrs. Staley have devised an external lens-hood which comprises a series of diaphragms, but which folds up into the small space of about 1 in. thick by 3 ins. diameter. The concentric rings which form the hood lock rigidly in position, and afford a complete protection against stray light. The hood should prove a valuable accessory to the user of both hand and stand cameras, and particularly to those who employ any of the modern air-space type of lens. The hood is made in two sizes: No. 1 for lenses up to $1\frac{1}{2}$ in., and No. 2 for those up to $2\frac{1}{4}$ ins. diameter. The price of the former is 10s. 6d., and of the latter 12s. 6d. The brass mount of the hood may be provided with a thread, or rubber or cork adapters can be employed to attach the hood to the lens tube.

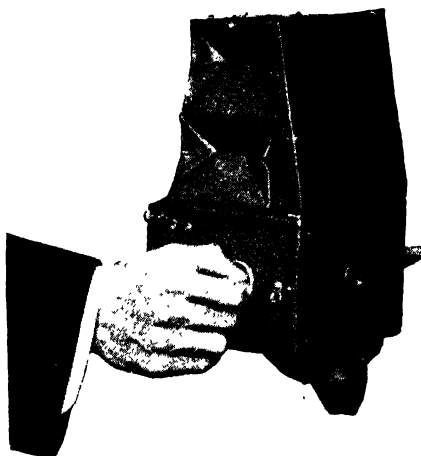
THE "PREMOGRAPH" REFLECTING CAMERA.

(Made by Kodak, Limited, 57 to 61, Clerkenwell Road, London, E.C.)

This instrument is not in any sense a competitor with the more elaborate models of reflex, but serves to place in the hands of the amateur worker, and that at a most moderate price, part of the advantages which result from the use of a mirror. In other words,



the "Premograph" is a quarter-plate camera in which a mirror is used to give a full-size image, and although the camera is not provided with any focussing adjustment, the gain in certainty which the full size of image confers can hardly fail to be appreciated by



the unskilled worker. The construction of the camera represents a reduction to the most elementary items further than which we can hardly imagine any camera of this type to go. The mirror is hinged at the upper part of the camera, and is set down by a

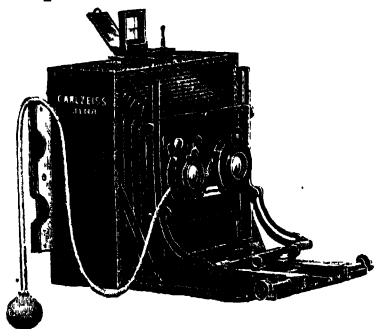
winding key on the right hand of the body, or is allowed to spring up flush with the focussing screen by turning the same winding key in the reverse direction. Similarly, to the bottom of the camera there is hinged a corresponding light metal plate provided with a velvet light-trap which forms with the mirror plate a shutter which can be used either for time or instantaneous exposures. For the former it is only necessary to set the small lever shown in the drawing at one end or the other of the metal plate, a turn of the winding key then commences the exposure, and pressure upon the small knob concludes it. For instantaneous work the lever is placed centrally on the plate, and a turn of the winding key then gives an exposure which we should judge to be something like one-thirtieth of a second. The camera is provided with a hood of $5\frac{1}{2}$ in. depth, which is self-erecting, and closes into a space of less than $\frac{3}{4}$ in. It is fitted with means for taking the Premo film-pack without adapter, and thus carries a supply of twelve quarter-plate exposures. At a price of two guineas the "Premograph" should find many adherents among amateur workers.

The No. 2 "Premograph," also quarter-plate, has provision for focussing, is fitted with R.R. lens working at $f/8$, shutter with speeds adjusted from $\frac{1}{2}$ to $1/100$ of a second, and lens protector, which opens immediately focussing commences, and automatically closes when the lens is racked back.

THE ZEISS UNIVERSAL PALMOS CAMERA.

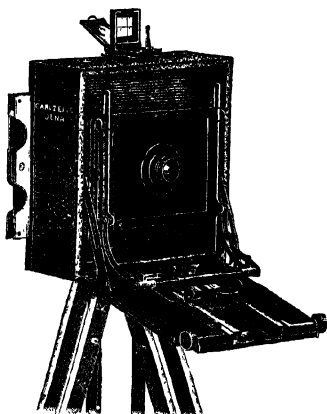
(Made by Carl Zeiss, Jena, and 29, Margaret Street, London, W.)

A special pattern of camera, taking plates 13×18 cm., or English 7×5 or half-plates, has been designed by the Carl Zeiss Works for use primarily on a stand, but also in the hand. The camera is of the self-contained dropping-baseboard pattern, measuring, when closed, $9 \times 9 \times 3\frac{1}{2}$ inches. The baseboard, on the camera being



opened, is instantly latched at right angles to the ground glass, and the lens-front can then be racked out without further adjustment, or separately drawn out by the spring clips on the front of the instrument. The net result of these two movements gives a total extension of 19 inches, and the opening of the camera to this full

length is a matter of only a couple of seconds. When using a wide-angle lens the baseboard is latched into a dropped position, shown in the second drawing, although the camera is racked in precisely the same way, and without any further adjustment, owing to the hinged device which attaches the front to the extension plate. The camera has rise and fall of front, both by means of the raising of the front as a whole, and also by means of a sliding lens panel. The swing front is very conveniently adjusted by a milled screw in the centre of the baseboard, which allows the front to swing both sides of the vertical position. Built square, the camera is fitted with reversing back, which is sprung into place simply by pressure of the back against the back frame of the body, being released by



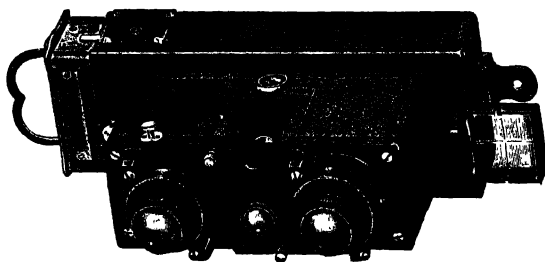
pressure on two studs on the top of the camera. For use in the hand two separate focussing scales are provided, and a direct-vision finder, which is fitted with a mirror, automatically springing up into a position at an angle of 45 degrees for use when holding the instrument in a low position. The whole outfit is most substantially made in light metal, every detail being of the mechanical perfection upon which the Zeiss Works justly prides itself. The instrument is suited for all descriptions of photography for which a half-plate camera may be used, the panel of the lens front being of a size suitable for stereoscopic work. The price of the instrument complete with finder is £17 10s., dark slides of the solid pull-out pattern are supplied at 17s., a stereoscopic division for 8s., and a leather case for carrying the camera and three double slides 26s.

THE VOIGTLÄNDER "STEREOPHOTOSCOPE."

(Made by Voigtländer and Sohn, 12, Charterhouse Street, London, E.C.)

This stereoscopic camera, constructed to take the now popular size plate of 107 x 45 mm. (4½ins. x 1½ins.), is made throughout in light metal, and provided with a pair of Voigtländer "Heliars" of

$f/4.5$ aperture, fitted in focussing mounts, which, like the iris diaphragm, are both actuated at the same time by lever adjustment. The focussing scale provided allows of focussing from infinity to 6ft. The camera carries a sunk finder of the ground-glass type, and a direct-vision finder for taking the stereoscopic pictures the other way of the plate. The shutter is one working between the



lenses, and is fitted with adjustment for time and a series of instantaneous exposures. The magazine fitted to the camera carries twelve plates, which are changed simply by drawing out the inside chamber and reinserting it, and the whole apparatus, the construction of which is of great mechanical perfection, is sold at £20, complete with focussing-screen, the whole packed in solid leather sling case. Extra changing boxes are sold at £3 10s.

THE "PANROS" FOLDING FOCAL-PLANE CAMERA.

(Made by Ross, Limited, 3, North Side, Clapham Common, London, S.W.)

Of this new pattern of folding focal-plane camera, which Messrs. Ross expect to have on the market early in the spring, the chief novel item is the focal-plane shutter, which combines a series of good features which would seem to represent the *ne plus ultra* of instruments of this kind. In the first place, the shutter is of the self-capping variety, the plate being kept covered except at the instant of exposure or when purposely set to time. In the second place, all the adjustments are made by the one winding-key of the camera, and the speed can be altered either before or after setting the shutter, and without any other adjustment than slightly pulling out the milled head of the winding-key, which is of size and gearing such that about a half-turn winds the shutter. "Bulb" exposures are made by turning the winder to "T" on the dial when the shutter opens, fully uncovers the plate on pressure of the release, and covers it again on pressure being released.

In addition to this, the mechanism of the shutter is such that on setting the aperture to a certain width the distance between the two blinds is locked, and no alteration in the width is possible while the shutter remains at this setting. Further, by turning the winged nut seen within the hollow of the winding-key the shutter (when in the down position) is opened to time, and is closed again by quickly turning the outside rim of the winder. All these adjust-

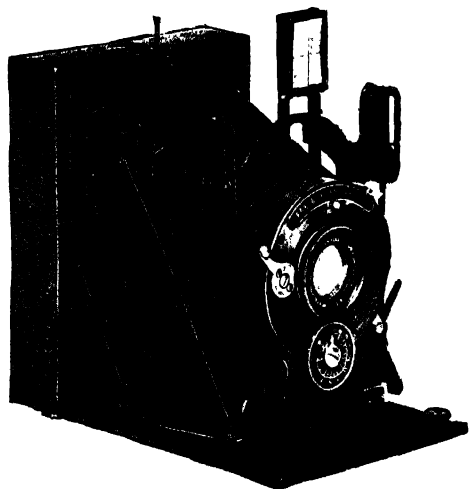
ments are most quickly and readily made, and the shutter is evidently of a kind which it is most difficult to derange.

The dark-slides supplied with the camera are worthy of special commendation as regards the spring which is used to keep the plate in position, and is inserted unpierced into the dark-slide, and, therefore, should be assured of constant use without splitting. Further, the space at the mouth of the slide is made of good depth, so that a finger-hole can be provided whereby to lift the plate quickly from the slide, and at the same time to provide an efficient plush cut-off of such depth that the insertion of the shutter, even skew-wise, into the slide will not admit light to the plate. The camera is supplied with the Ross "Homocentric" lens, at prices which will be on all fours with those charged for similar high-class instruments of this pattern.

THE "VESTA" POCKET CAMERA.

(Made by Adams and Co., 24, Charing Cross Road, London, W.C.)

A camera with a full range of movements reduced to the smallest dimensions is the very strong claim which Messrs. Adams make for their new instrument, the "Vesta." And the use which we have been able to make of the camera in our own work fully justifies us in endorsing the makers' contention as to the prac-



tical facilities provided within the extraordinarily small space of $4\frac{3}{8} \times 3\frac{3}{8} \times 1\frac{1}{4}$. The measurements are our own, and apply to the smaller of the two sizes of "Vesta" which are at present made—namely, the $3\frac{1}{2} \times 2\frac{1}{2}$. We must confess that on other grounds than that of bulk we would choose this $3\frac{1}{2} \times 2\frac{1}{2}$ size in preference to the quarter-plate. The optical conditions are all in its favour, focussing

is practically unnecessary, and a 15 x 12 enlargement from the smaller plate is every bit as sharp as, if not sharper than, that from a quarter-plate taken at the same angle. The "Vesta" is of the falling base-board type. The lens front is extended on lazy tongs and affixed to the baseboard by attaching two catches to a pair of studs. The front is kept pressed against the studs by two springs, one of which is shown in the drawing of the open camera. When set up the front is extremely rigid, and is fixed in the exact parallelism with the plate necessary with the modern flat-field anastigmat of large aperture. The operation of opening the camera and preparing it for an exposure is the work of a few seconds.

Perhaps the most notable feature of the "Vesta" is the rise of front available both ways of the plate. The camera is built the vertical or "portrait" way of the plate, and the lens panel has a rise of over three-quarters of an inch in this direction. But the whole lens front also moves in the other direction, and provides a rise of $\frac{3}{8}$ of an inch "the landscape way" of the plate. Movements of these dimensions on a plate $3\frac{1}{2}$ by $2\frac{1}{2}$ are, as the reader knows, amply sufficient for all but the most extraordinary requirements. In the case of both movements the lens on being pushed down is automatically stopped opposite the centre of the plate.

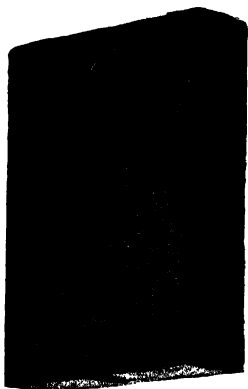
Of the other movements, the focussing scale is graduated from infinity to two yards, but, as we have said, in the case of a lens of four inches focus, such as that fitted to the "Vesta," the depth of focus or field is very great, and the necessity of the exact use of a focussing scale is far less imperative than when using lenses of longer focus. The finder is of the direct vision type and is affixed to the lens front, with which it moves when raised in either direction, thus giving, in conjunction with the sighting rod on the back of the camera, a better approximation of the displacement of the picture due to the rise of the front than when the finder is a fixture. The "Vesta," too, is fitted with two bushes for affixing it, either way of the plate, to a tripod.

The shutter fitted to the camera is the well-known "Compound" with time and bulb adjustments and a range of speeds instantly alterable before exposure merely by turning the adjusting disc, say, from the starting point (1 second) to its extreme limit (1-250th of a second).

A focussing screen is provided with the camera and is held in the back by a convenient lever clip, which likewise retains firmly but instantly releases the single metal dark-slides, six of which are included in the outfit. Messrs. Adams make the body of the slide of aluminium, the shutter only of steel, thus saving a good deal of weight, while avoiding the danger of fog which is involved in the use of an aluminium shutter. The shutter of the slide, after it has been withdrawn, can be fixed behind three clip heads on the back of the camera, and thus secured from risk of becoming bent or damaged.

The whole apparatus is made largely in aluminium alloy, and is covered throughout in black leather. When closed for carrying the

whole of the working parts are encased, and the finder, it should be mentioned, automatically turns over and folds itself within the camera as the baseboard is shut down. Altogether the "Vesta" is a triumph of construction, and a camera which will serve the tourist well amidst the greatest variety of subjects. Complete, with Ross Homocentric $f/6.3$ and six single metal slides, its price is £10 10s., or with Zeiss Protar $f/6.3$ £13 15s. In quarter-plate size these prices are £12 and £16.



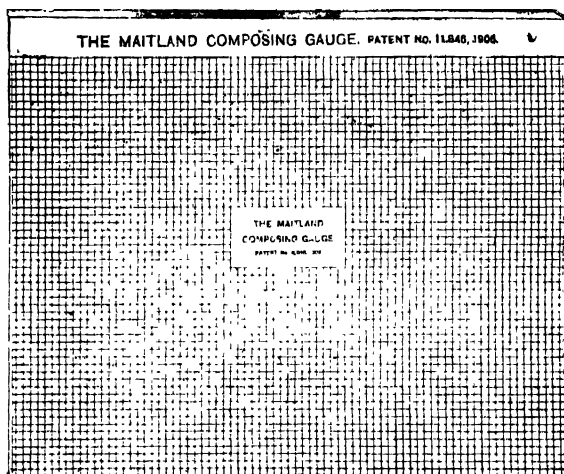
Messrs. Adams and Co. are preparing to still further enhance the value of this exceedingly small pattern of camera by supplying it with Zeiss Tessar $f/4.5$ lenses, both in the $3\frac{1}{2} \times 2\frac{1}{2}$, as well as the $\frac{1}{4}$ -plate size. The dimensions are practically the same as given above, but exact details are not to hand at time of going to press. As there is nowadays a large demand for lenses working at $f/4.5$, it is certainly a distinct advantage to be able to use lenses of large aperture upon such a small camera. We understand the "Vesta" is the only small pocket instrument made that will take such quick-acting lenses.

THE "MAITLAND" COMPOSING GAUGE.

(Sold by W. Butcher and Sons, Limited, Camera House, Farringdon Avenue, London, E.C.)

A most useful aid to the trimming to odd sizes of any prints up to $9\frac{1}{2} \times 7$ in. is provided by this invention of Viscount Maitland (See this "Almanac," 1908, p. 673), the actual means for utilising the device being now placed on the market by Messrs. Butcher. The composing gauge consists of a thin sheet of almost transparent tracing paper ruled accurately into $\frac{1}{4}$ in. squares. In using it, the gauge is laid over the print, and the portion which it is desired to trim down to a perfectly rectangular shape is then marked

on the print by passing a pin or needle through the point in the gauge. It is then only necessary to lay a straight-edge from point to point, preferably on the back of the print where the points are more clearly visible, and the requisite portion of picture is then



obtained perfectly square and without any trouble of measuring or gauging the truth of the right-angled corners. Twelve of these ruled gauges, fixed to a cardboard back, form a pad which is sent out, complete with instructions for use, at the price of 1s.

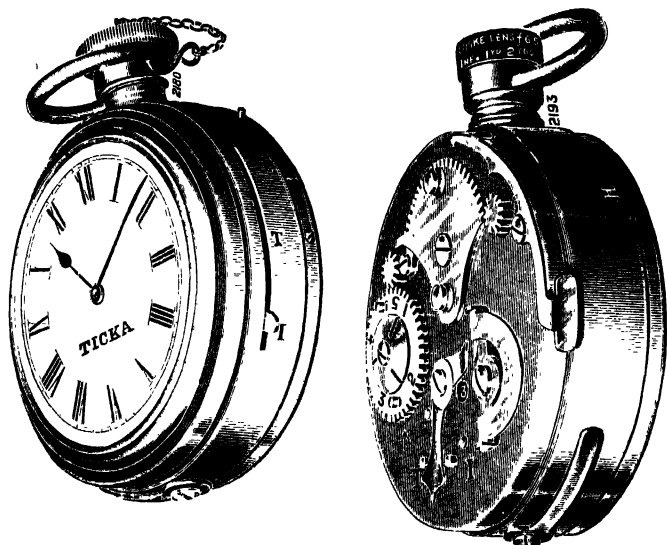
WATCH FACE AND FOCAL-PLANE "TICKA" CAMERAS.

(Made by Houghtons, Limited, 88 and 89, High Holborn, London, W.C.)

Messrs. Houghtons, Limited, have this year provided a new model of the "Ticka" camera, one face of which is quite an ordinary watch dial, the two hands, which stand at seven minutes past ten, serving as a pair of lines roughly indicating the angle of the picture. The camera thus held in the hand may be mistaken for an ordinary watch by any passer-by, and the great depth of focus possessed by the small lens with which it is fitted enables photographs to be taken at quite close quarters. The price of the watch-face "Ticka" is 10s. 6d.

The focal-plane camera, which is little larger than an ordinary watch, and is fitted with a "Cooke" focussing lens working at $f/6.5$, is the other very novel variant of the "Ticka." The shutter is adjustable to five different speeds, and may be used for time

exposures, the range of shutter exposures being from about 1-75 to 1-400 sec. The arrangements for the exposure of the twenty-five



sections of film are the same as in the ordinary "Ticka." The price of the focal-plane, which is a really nicely made instrument, is £2 10s.

THE "TRIO" ALDIS LENS.

(Made by Aldis Bros., Sparkhill, Birmingham.)

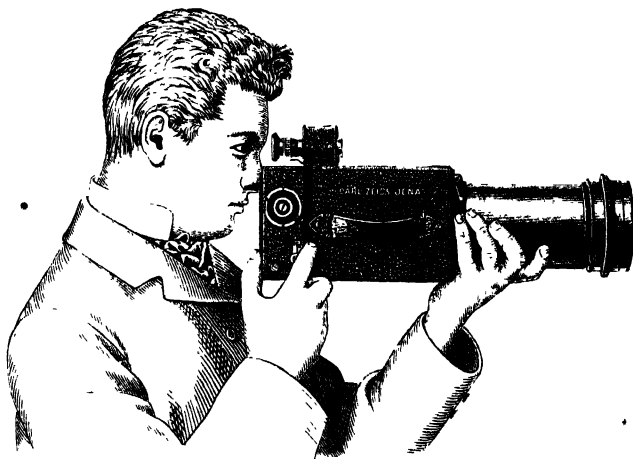
In last year's "Almanac" we reviewed and described the "Duo" Aldis lens, a special front combination which when used with the back combination of an ordinary Aldis lens gives a doublet of approximately double the focal length and double the covering power. The "Trio" is a similar front combination designed to increase the focal length only one and a half times, and it is thus better suited to cameras that will not extend sufficiently to enable the "Duo" to be used. The "Trio" submitted to us is intended for use with the well-known and popular No. 2 Aldis, Series 2, of $5\frac{1}{2}$ in. focal length and $f/6$ aperture. On changing the front combination for the "Trio" we have an $8\frac{3}{4}$ in. doublet, working at a full aperture of about $f/9$, and, according to the makers, giving very fine definition over a 7 in. circle. As a matter of fact, however, we find it behaves very well indeed over a half-plate, and the circle is sufficiently large to enable a much larger plate to be covered with smaller stops. The corrections of this modified doublet are

very good indeed, astigmatism being absent, while the field is very flat. A small point of light can be sharply focussed in any part of the 7 in. circle. As in the case of the "Duo," the spare combination is provided with a brass protecting cap, and the mounting and finish are fully up to the well-known standard set by Messrs. Aldis in their other lenses. The price of the "Trio" is not announced at the time of writing, but we are informed that it will be considerably cheaper than the corresponding "Duo."

THE ZEISS TELE-CAMERA.

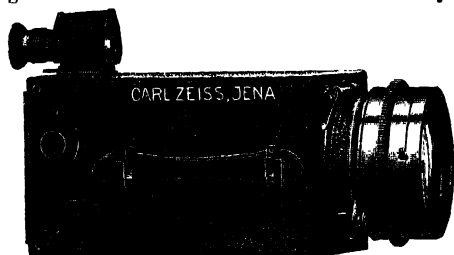
(Made by Carl Zeiss, Jena, and 29, Margaret Street, London, W.)

This camera is an instrument specially made for natural history, landscape, and portrait work, and permits of advantage being taken of the new Zeiss telephoto lens. The camera consists of a metal leather-covered case, measuring $8\frac{1}{2} \times 5 \times 6$ inches, and fitted with the "Palmos" focal-plane shutter. The lens is mounted on a tube about $9\frac{1}{2}$ inches in length in such a way that excepting the portion carrying the iris diaphragm and



the adjustment for objects at various distances the tube pushes inside the camera, leaving a projecting portion only 2 inches deep. This adjustment is very rapidly made simply by raising the spring catch and then turning the clamp seen in the illustration. The weight is thus very nicely distributed for carrying, whilst the bushes, serving to fix the camera to a tripod, are placed right in the front, so that the weight is again fairly equally distributed when the camera is in use. The production of a telephoto lens at the large working aperture of $f/10$, and a focal length of 32 inches, is surely

a triumph, when it is considered that the distance from lens-hood to plate is only 17 inches, whilst, with the camera closed, this is reduced to 10½ inches. The camera is naturally weighty, but for special long-distance work of all kinds is a remarkably fine instru-

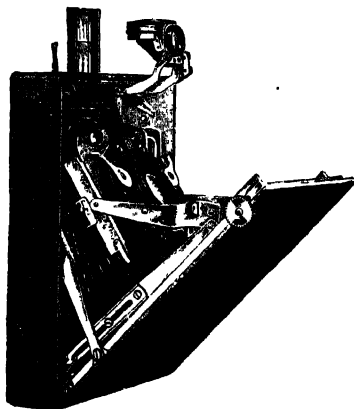


ment. The adjustment for focussing on distant objects provides a range from infinity to five yards, but while the image can be focussed on the ground glass there is also provided a binocular field glass of four magnifications, which serves as a finder. The price of the camera complete, with lens, shutter, and finder, is £40.

THE ERNEMANN "SPRING" CAMERA.

Sold by Charles Zimmermann and Co., Limited, 9 and 10, St. Mary-at-Hill, London, E.C.4

The name is most apposite, for many things happen when the spring button which releases the dropping baseboard of the camera is pressed. Simultaneously, the lens front erects itself centrally



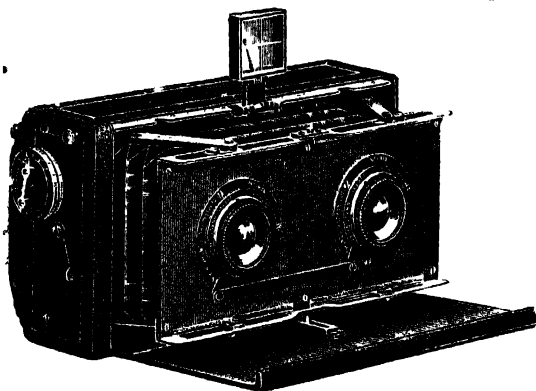
with the plate and in the position of focus for distant objects, a bright finder and level come into position, and a direct-vision finder for use when the camera is held at the eye level also springs into place—all as the result of simply pressing the knob at the side of

the instrument and lowering the baseboard. When the camera is closed by pressing on the two spring side struts these operations take place in the reverse order, the whole of the mechanism disappearing within the case of the instrument. Apart from this feature the camera possesses a range of movements which are looked upon as essential in instruments of this class. It has a double extension, giving $10\frac{1}{2}$ inches from lens to plate. It has a rising front of nearly one inch the upright way of the plate. The shutter, which is the Ernemann Bob Sector, is of the diaphragm ever-set pattern, and can be used for a range of exposures and for time and bulb adjustment. A focussing hood, which really shields the ground-glass from extraneous light, is provided, and the instrument can be used either with dark-slides or film-pack adapter. In quarter-plate size, without lens or shutter, the price of the "Spring" is £6 17s. 6d., or with Ernemann aplanat, $f/6.8$ and shutter, £7 17s. 6d. A camera of the smallest dimensions, and from its novel movements one which a dealer should find eminently saleable.

THE "STEREO-KIBITZ" FOCAL-PLANE CAMERA.

(Sold by May & Co., 22, St. Paul's Road, Seacombe, Liverpool.)

From the Westminster Photographic Exchange, of 119, Victoria Street, London, S.W., who are one of several special agents, we have received this very portable stereo camera, which measures only $6 \times 3 \times 1\frac{5}{8}$ ins., and takes a plate 45×107 mm., as used in instruments such as the "Verascop" and "Stereo-Blocknote." On opening the



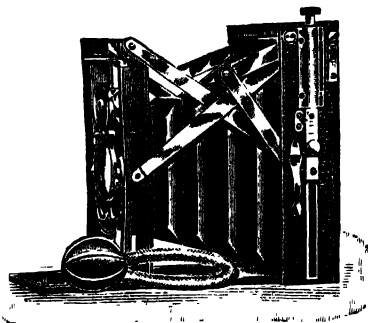
front the lens panel at once springs into the position of fixed focus for near and distant objects. The short focal length of the lens, about $2\frac{1}{2}$ ins., makes focussing practically unnecessary. The alteration in speed of the focal-plane shutter, which latter is of the self-capping pattern, is made simply by pressing inwards the T handle forming the centre of the winding key and turning the indicator to the

width of slit required. This gives a range of speeds from 1-25 to 1-1000 sec. Complete with a pair of Busch Aplanat lenses working at $f/6$, and with six metal slides, the price of the camera is £8 17s. It may be fitted with a magazine changing box for £4. The finder is of the direct-vision pattern, and shows a picture of shape corresponding with that of one of the pair of negatives. A stereoscope for viewing the transparencies with this camera takes the form of a small pair of binoculars, and costs 15s. The stereoscopic pictures produced by a camera of this type represent the most readily made and effective form of stereoscopic photography, the results being perfectly sharp from foreground to distance, yet when viewed in the stereoscope giving a marvellous rendering of detail.

THE "KIBITZ" CAMERA.

(Sold by May and Co., 22, St. Paul's Road, Seacombe, Liverpool.)

A folding pocket camera of very small dimensions and presenting certain novel points of construction is issued under this name in two sizes—namely, for plates $3\frac{1}{2} \times 2\frac{1}{2}$ and quarter-plate. The latter measures, when closed, $5\frac{1}{2} \times 4\frac{1}{4} \times 1\frac{3}{8}$ ins., and extends to $6\frac{1}{2}$ ins. As illustrated, the front is held by a system of lazytongs, which give very great rigidity, and allow of a rise and fall movement of $1\frac{1}{4}$ ins. The focussing adjustment is made by a milled screw fixed to the top of the body. This actuates the lazytongs extension, from which it follows that the camera can be set to any focus, and will always



come to this point when pulled out. To close the camera a nickel knob moving in the focussing scale is pressed, when the front can be closed. It is certainly an advantage to be able to pull the camera out into position for focus on objects at some predetermined distance. The focussing provides for objects from 6 ft. to infinity. The camera is fitted with "Compound" shutter and "Nettel" aplanat working at $f/7.5$. Complete with six single metal slides, the price is £6 5s. in the quarter-plate size, or £5 3s. in $3\frac{1}{2} \times 2\frac{1}{2}$. The finder is a direct-vision, which automatically springs up when the camera is opened.

THE ZEISS "PROTAR" CONVERTIBLE LENS, SERIES IV.

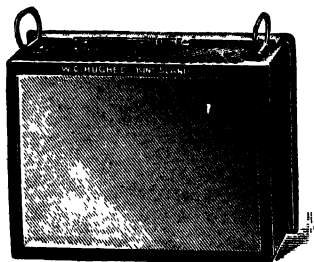
(Made by Carl Zeiss, Jena, and 29, Margaret Street, London, W.)

A successor to the famous Series VI. "Protar" anastigmat has been brought out by the Zeiss Works in the newly introduced Series IV., which is of simpler construction than Series VI., and is listed at a somewhat lower price. The lens consists of a triple cemented doublet, the single component of which works at $f/12.6$, whilst the complete lens has a working aperture of $f/6.3$. The doublets are made up of single components, either of equal or unequal focal length, doublets made up of the latter usually working at a slightly reduced aperture; for example, $f/7$, compared with $f/6.3$. The advantage of an unsymmetrical construction is, however, that a choice of three focal lengths is thus afforded. The doublet No. 5.5 is thus composed of two single components, each of 300 mm. focal length, has a focus of 173 mm. (6.8 inches), and covers, at the full aperture, a plate $6 \times 4\frac{3}{4}$ inches, or, with slight stopping down, $8\frac{1}{2} \times 5$. The price in standard mount is £7 13s.; or, in focusing jacket, £8 5s. The "Protar" series are also issued in sets of elements giving a range of focal length suitable for quarter-plates, half-plates, and 10×8 , the price of the first being £9, that of the second £11 15s., and of the third £22 15s. The optical qualities and the mechanical workmanship are of a quality which we have learnt to expect from the Jena Optical Works.

RECTANGULAR CONDENSERS.

(Made by W. O. Hughes and Co., 82, Mortimer Road, Kingsland, London, N.)

A special form of these well-known and convenient condensers has been made up in a separate mounting which allows of their being used in any form of enlarging apparatus, which can thus be

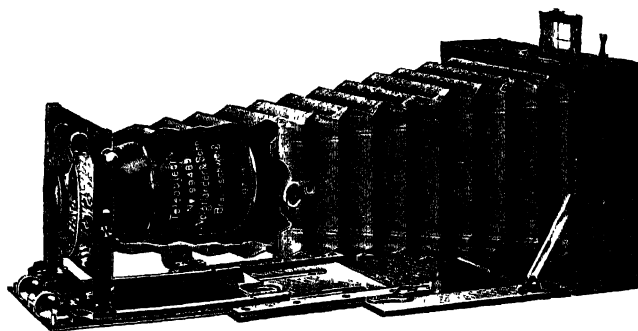


constructed of smaller size owing to the less space taken by the condenser. The glasses are annealed against fracture by heat, and are sold at the price of £1 15s. quarter-plate, £2 2s. 5×4 , and £3 3s. half-plate, the condensers in each case being slightly larger than the dimensions of the plate, for example, $7\frac{1}{2} \times 5\frac{1}{2}$ in the case of half-plate.

THE "ALPINE" TELEPHOTO ATTACHMENT.

(Made by Voigtlander and Sohn, 12, Charterhouse Street, London, E.C.)

In order to provide for large pictures of distant objects when using the excellent "Alpine" camera, reviewed in last year's "Almanac," the makers have designed a convenient telephoto attachment, which screws inside the camera to the back of the lens mount, and thus provides for an equivalent focal length $2\frac{1}{2}$ times that of the positive, and at an extension of about 8 ins., which is well within the range provided by the "Alpine" camera. The telephoto attachment is mounted in a double-extension tube, and is



quickly placed in position by removing the ground-glass of the camera. The convenience of having a lens of 12½ ins. focal length, which does not in any way alter the outside appearance of the camera, and works at an aperture of, say, $f/18$, should be a further inducement for the tourist photographer to pin his faith to this well-made instrument. The price of the "tele-tube" complete, in case, is £3. The accessory gives an image which excellently covers the quarter-plate.

THE "HERMAGIS" APLANASTIGMAT AND TELEPHOTO COMBINATION.

(Sold by F. C. Clarkson, Colchester.)

A No. 7 Aplanastigmat of aperture $f/6.8$ and focal length 210 mm., or about 8½ ins., has been submitted to us for trial, together with an Hermagis tele-objective, to be used with it. The positive doublet appears to be symmetrical in construction, and it can be used divided, the single combination giving excellent definition. The complete doublet is a very fine example of an anastigmat, and ranks with the few that show absolutely no astigmatism at fairly wide angles. On a half-plate we can detect no signs of this defect. On throwing the image a little out of focus the existence of very slight residual traces of spherical aberration can be detected, but nowhere is there any indication of a linear focus. The field is very fairly flat, and altogether the lens is one of a very useful and

valuable type, and eminently well suited to a half-plate camera. On testing the combination with the tele-attachment, at a magnification of $6\frac{1}{2}$, a most satisfactory result was obtained. The definition was as good as could be wished, for the exposure was very short, three seconds on an Ilford ordinary plate being ample exposure, though the working aperture of the whole combination was $f/44$, and the focal length 4 ft. 6 ins., the total projection of the telephoto combination being 8 ins.

THE FOCAL-PLANE FOLDING "RUBY" CAMERA.

(Made by the Thornton-Pickard Manufacturing Co., Limited, Altrincham.)

In issuing a focal-plane pattern of the well-known "Ruby" camera the makers have adopted the new model of the Thornton-Pickard focal-plane shutter, namely, that with three separate slits in the same blind. On winding the latter to the full the third and narrowest slit is indicated as set ("No. 3 set"), and pneumatic or finger release then gives the exposure, and leaves slit No. 2 in position. This latter on pressure of a small stud on the left of the camera is unlatched, and allows of exposure being made on a further release, and, lastly, a third pressure will uncover the whole plate. This latter movement allows of time exposures being given by opening the focal-plane shutter, and concluding exposure by capping the lens or using a lens shutter. As regards the other features the camera has the universal "Ruby" front, the great rise and long extension, the dropping base-board for short focus work, and the other conveniences which are familiar to users of this model of camera.

It should be mentioned that the second aperture of the blind gives exposures from 1-20 to 1-140 secs., whilst the narrowest slit allows of exposures from 1-200 to 1-1000 secs., sufficient range in each case to make it unnecessary to alter the aperture in use when working on a given description of subject. The adjustment of speed for a given slit-width is made simply by altering the shutter tension, as seen on the indicator at the back of the camera, which indicator is almost exactly similar to that employed with the Thornton-Pickard roller-blind shutter. The price of the focal-plane folding "Ruby," with Beck aplanat lens working at $f/7.7$, Bausch and Lomb "Automat" lens-shutter, three double slides, brilliant finder, and spirit level, is £8 15s. in quarter-plate, £10 in 5 x 4, £11 in postcard, and £13 5s. in half-plate size.

THE TAXIPHOTE STEREOSCOPE (FOR VERASCOPE TRANSPARENCIES).

(Made by Jules Richard, 23A, Albemarle Street, London, W.)

A most ingenious stereoscope is made by this well-known firm and maker of the Verascope camera. The latter, we may perhaps mention, takes a plate 10.7 cm. by 4.5 cm.—i.e., about 4in. by $1\frac{1}{2}$ in., and gives a negative which is extraordinarily sharp, even when obtained as a snapshot, owing to the short focus of the anastigmats

used and the mechanical perfection and accuracy of the workmanship of the instrument. No less admirably adapted to its purpose is the box stereoscope which bears the name at the head of this review, for it provides for the observation of an unlimited number of stereoscopic transparencies without once touching them with the fingers, while it is provided with adjustments, whereby the lenses are suited to the eye of the observer and the pictures changed by him by one pressure on the lever at the side of the case. Moreover, the instrument can also be used in projecting the transparencies.

These facilities owe their existence to a mechanism whereby each transparency is picked out of a grooved tray holding twenty-five of them, raised into the position for viewing, and returned, when desired, to its groove. Not only this, but by setting a lever and pointer any given picture of the twenty-five can be brought into position. When all have been looked at, the tray containing them is withdrawn and replaced by another in a second or two. As the case below the stereoscope proper accommodates twelve trays each of



twenty-five subjects, the apparatus provides its possessor with a series of 300 views, any one of which can be instantly removed or replaced by another.

In using the Taxiphote for projection the ground glass which backs the transparency is removed, and any convenient source of even illumination—*e.g.*, a condenser with arc light or limelight brought up behind the transparency—one of the viewing lenses then serving for projection. The conversion from viewing instrument to projection lantern does not call for any structural alterations to the apparatus, and the same remark applies to the use of the Taxiphote for enlarging from a *Verascope* negative. The price of the complete instrument is £10 12s. 6d.

NEW KODAK CAMERAS.

(Made by Kodak, Limited, Clerkenwell Road, London, E.C.)

Among the additions to the series of folding and box cameras made by the Kodak Co. is a No. 1a "Folding Pocket Kodak Special," taking pictures $4\frac{1}{4} \times 2\frac{1}{2}$ ins. It is a film camera representing the latest improved model of the Eastman manufacture—namely, the automatic focussing scale, by which the scale has only to be set to a certain distance and the front then pushed up against the stop, an operation which does not call for accurate placing of the indicator as when using the ordinary scale. The camera carries the F.P.K. automatic shutter, finder, and attachment familiar to users of folding Kodaks. Its price is £3 3s. The "Premoette" for $3\frac{1}{4} \times 2\frac{1}{4}$ pictures is a larger size of the guinea cameras of this series which is made to take the Premo film pack. Sold at £2 2s., it is fitted with the R.K. lens, automatic shutter, focussing scale, and reversible finder, and measures when closed $2\frac{1}{4} \times 4\frac{1}{2} \times 3\frac{1}{4}$ ins.

The No. 3 "Bull's Eye" Kodak is a new size of this series of box film cameras, taking a quarter-plate picture, and fitted with Eastman rotary ever-set shutter, achromatic lens with three stops, two finders, two tripod sockets, and daylight-loading film mechanism. Its price is 36s.

"BROWNIE" ENLARGER.

(Made by Kodak, Limited, Clerkenwell Road, London, E.C.)

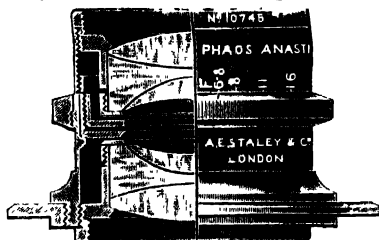
Two new sizes of the collapsible fixed-focus enlarger are now obtainable. The No. 3 takes negatives up to quarter-plate size, from which latter it gives a whole-plate enlargement. The No. 4 takes negatives up to 5×4 , and gives an enlargement 10×8 ins. Like the original enlarger, the two new patterns are strongly made, and, though of the simplest form of construction, are nevertheless efficient for their purpose. The prices are:—No. 3, 12s. 6d.; No. 4, 17s. 6d.

THE "PHAOS" ANASTIGMAT.

(Sold by A. E. Staley and Co., 19, Tavies Inn, Holborn Circus, E.C.)

This is a symmetrical double anastigmat of low price but very good quality. The specimen (of 7 in. focal length and aperture $f/6.8$) that we have tested proves to be an excellent lens for half-plate work, as it is free from astigmatism, and gives sharp definition in all parts of the plate at full aperture. The field is very slightly curved at $f/6.8$, but this is not a matter of much practical moment. As far as the construction of the lens is concerned, the form of two combinations of three cemented lenses, having no air space, is adopted. The lens combinations are symmetrical, thus giving a single lens—either back or front used alone—of double the focus of the combined lens, and consequently working at an aperture of about $f/13.5$, sufficiently fast for all long-distance landscape work. The brilliance of the complete lens is remarkable, and the definition

to the margin of the plate for which it is made very critical. The single combination also gives good definition at full aperture. The usefulness of $f/6.8$ lenses of the double anastigmat type has long been proved. They are well suited to all purposes except the most

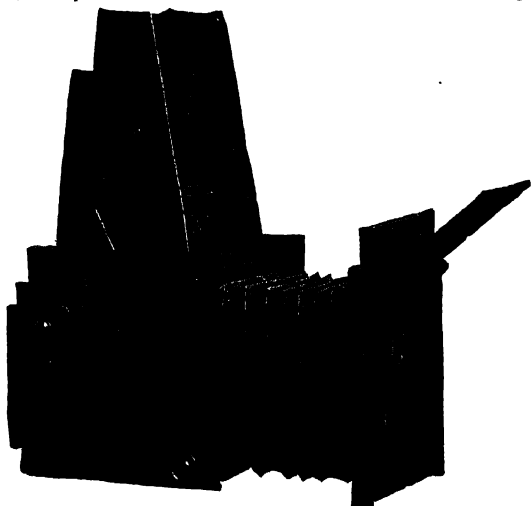


rapid focal-plane work, and when they can be obtained for the prices quoted by Messrs. Staley they form excellent bargains. The "Phaos" costs 50s. for a $4\frac{1}{4}$ in. lens, and 72s. 6d. for a 7-in. lens, and these are, perhaps, the two most useful focal lengths.

ADAMS "POPULAR" AND "DE LUXE" VIDEX REFLEX CAMERAS.

(Made by Adams and Co., 24, Charing Cross Road, London, W.C.)

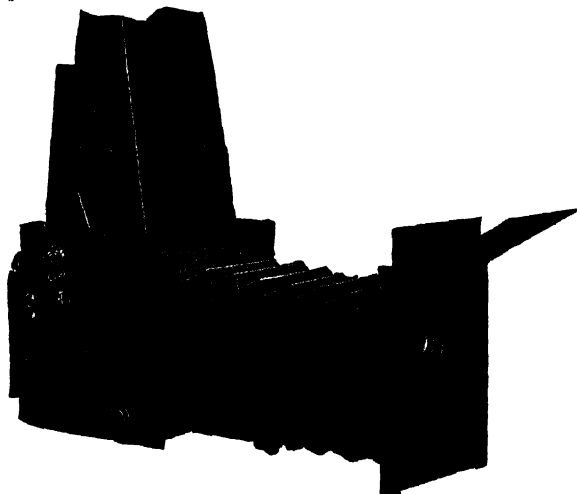
During the past season Messrs. Adams have revised the prices of



"Videx" Popular Model.

these well-known cameras, offering the "Popular" model at 15 guineas in quarter-plate size, and the "De Luxe" model at £27,

the price of the "Videx" as previously issued having been £25 10s. The "Popular" model, while not possessing the great range of movements of the "De Luxe," is nevertheless a reflex camera of the most excellent pattern and design, and wonderful value for the price charged for it. It has the standard features which have been appreciated on the previous model, such as the rotating back, square, reversible, and detachable lens panel, large lens shade, self-erecting hood, which is covered when not in use by the top of the camera, rising front, etc., and is fitted with the new model of Mr. Adams' focal-plane shutter, having a quick wind, instant alteration of speed (while the shutter is set) either backwards or forwards,



"Videx" De Luxe Model.

together with time exposures, which are made independently of the mirror. Moreover, this new Adams shutter provides for exposures which can be commenced by pressure upon the stud seen in the drawing, and concluded by releasing the same. The balancing of the shutter and the rack and pinion adjustment of the front are excellently contrived, and the camera, which has an extension of $10\frac{3}{4}$ ins., is just as applicable as the more expensive "De Luxe" pattern for the attachment of the Adams' four-way swing front, lens-mirror, etc.

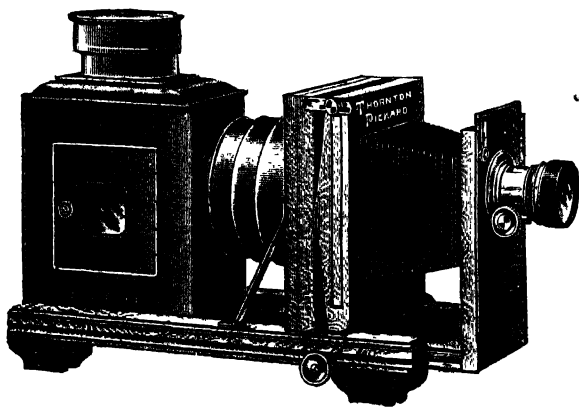
In the "De Luxe" model a triple extension is provided permitting of a distance from lens to plate of 14 ins. in the quarter-plate size. This is done with a pair of rack struts which most compactly work within the back pair, and are actuated by a pinion rod which is braced across the main rack struts. At the full extension the front is remarkably rigid. The hood can be immediately raised,

giving access to the focussing screen, which latter can be removed on turning a pair of buttons and reversed, as necessary when using Autochrome plates. The mirror is likewise thus quickly got at for dusting. A recess is also provided in the body of the camera for carrying the tripod screw, loose lens cell, etc. The shutter is of the quick-wind bulb, time and instantaneous pattern already noticed, but has an additional attachment for the Antinous release. This feature of the "De Luxe" shutter is particularly valuable since it allows of automatic pneumatically controlled exposure being given, the available times being $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, and 3 seconds. This same convenience which in outdoor photography is one of great practical value, may be obtained on the "Popular" shutter at an additional charge of 25s. With woodwork of teak and covering of black sealskin of hard grain, the camera is recommended for use under trying conditions, and, although possessing the great range of movements above described, has the small dimensions of $6\frac{1}{2} \times 7 \times 5\frac{1}{2}$ ins. in quarter-plate size.

THE THORNTON-PICKARD "A" MODEL ENLARGER.

(Made by the Thornton Pickard Manufacturing Company, Ltd., Altrincham.)

In this new introduction of the Thornton-Pickard Co. the base, stage, and front of the enlarger are of polished mahogany, the condenser stage being supported by two heavy brass struts, which give the much desired rigidity to this part of the enlarger. The stage is



built open, and pivotted centrally, so that it can be tilted in either direction, and thus any distortion in the negative corrected by the use of this movement in conjunction with a similar movement of the easel. The clamp which serves to fix the stage at any desired angle also automatically secures it in the perpendicular position. In addition, a see-saw movement (actuated by rack work) of the base of the negative stage allows of the negative being tilted the other way,

this adjustment being more conveniently made by such tilting than by pinning the paper at an angle upon the easel. Rising and falling front and collapsible triple extension condenser cones are provided. The latter allow the lantern body to be brought towards and away from the condenser, the lantern body itself moving on a mahogany base. One little point is worthy of mention, namely, that the focussing pinion is provided with a head on either side of the enlarger, and is so adjusted that a forward movement of the head moves the lens forward, and a backward movement draws it back, a synchronism which is on all fours with that universally adopted in field cameras, but not invariably in those used for enlarging. Complete, with 5½ in. condenser and enlarging lens fitted with rack and pinion adjustment, iris diaphragm, and orange cap, the price of the outfit is £4.

ROSS NEW PHOTO-MICROGRAPHIC APPARATUS.

(Made by Ross, Limited, 3, North Side, Clapham Common, London, S.W.)

In this most substantial and practical piece of apparatus the makers have embodied a number of features which fit the apparatus for the most varied purposes of photo-micrography, particularly the use of the long or short extension of camera and for oblique and right-angle illumination. The full extension of camera is secured by pulling out an additional extension from the rear of the base-board, on releasing a clamp shown placed conveniently on the base-board. This adjustment has the advantage that when the camera is used at an extension less than the full the eye can still be placed close to the focussing screen without straining the body over a projecting baseboard. The optical bar carrying the Nernst lamp, condenser, and other illuminating system can be placed either at right angles to the baseboard, or instantly unhitched and placed axially with the camera. In either position the angle of illumination can be controlled by winch screws placed to the rear of the focussing screen, so that this adjustment, and also that of actually focussing the microscope, can be done while the image is viewed on the screen. The camera is of most rigid construction, the essential moving parts are of metal on metal, and the whole workmanship is solid and substantial. The price as described, but without the optical attachments on the bar, is £26.

ISOSTIGMAR ANASTIGMATS, SERIES $f/6.3$ AND $f/4.5$.

(Made by R. and J. Beck, Limited, 68, Cornhill, London E.C.)

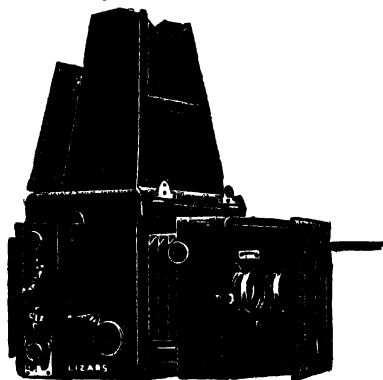
Of the Series IV. (wide-angle), $f/6.3$, the lens we have tested is of 4½ focal length and full aperture of $f/6.3$, and covers an angle of about 80deg., these particulars being according to our own measurements. It is intended for use on a quarter-plate as an ordinary lens, or for a half-plate when used as a wide angle. In the latter case the rising front can be used to an extent of 1 in., while in the former a rise of 2½ ins. is available. The lens behaves exceedingly well in our hands. It has a very flat field, and the correction for oblique light is as strikingly perfect as in the older types of Isostigmat. The prices are moderate, seeing that they range from £3 15s. to £5 5s. in a series of five lenses of focal lengths from 3½ ins. to 7½ ins.

The Series I. ($f/4.5$) is a new series of the Isostigmat, specially designed for the most rapid work. The lens we have tested is a No. 3 of focal length, 4.6 ins., according to our measurements, and for a lens of such rapidity and cheapness its effects are somewhat striking. It gives a circle of illumination of $5\frac{1}{2}$ ins., and will therefore just cover a quarter-plate, though the hand camera to which it will be most perfectly suited will be one of the popular $3\frac{1}{2}$ by $2\frac{1}{2}$ size. At full aperture it gives extremely fine definition in the centre of the plate, while the falling-off towards the margins is very slight, much less than we expect to see with the ordinary R.R. lens working at $f/8$. For the sake of comparison, we tested this Series I. Isostigmat against a Series II. $f/5.8$ lens, using the same aperture— $f/8$ —in both cases. As a general rule, an $f/4.5$ lens need not be expected to perform quite so well at $f/8$ as a lens of similar quality constructed to be used at $f/5.8$, but in this case there is very little difference. The circle covered by the Series I. lens is slightly smaller, and much more clearly defined at the margins. The marginal definition of the image is, however, very little inferior to that of the other, while the evenness of the illumination is as good, if not a shade better. In fact, the $f/4.5$ lens, even at its full aperture, seems to give very satisfactory illumination. The most marked difference between the lenses is in the matter of depth, the new lens having distinctly less near depth and greater far depth than the older one when focussed on an object 8 ft. away.

THE LIZARS' REFLEX CAMERAS.

(Made by J. Lizars, 101, Buchanan Street, Glasgow, Scotland.)

The latest introduction by the firm of Lizars is a stereo postcard or panel, size $6\frac{3}{4}$ ins. by $3\frac{1}{4}$ ins., of the well-known "Challenge"



de Luxe reflex camera, of which we have in the past been compelled to speak in appreciative terms. The new size is an instrument which, while convenient for the general purposes of the tourist, takes a picture which is quite large enough for Press purposes, and is,

moreover, a very convenient size for stereo work. Closed, the camera measures outside 8 ins. by $7\frac{1}{2}$ ins. by 6 ins. and, whilst having all its working parts covered, such essential portions of the apparatus as the focussing screen, mirror, and the lenses are instantly got at. The lenses as arranged for stereoscopic work may be given any necessary separation, which is shown by the scale on the lens panel, and in other respects the camera has all the good points of this well-known type of reflex. With three double book-form dark slides, carrying plates $6\frac{3}{4}$ ins. by $3\frac{1}{4}$ ins., and with a pair of 6-in. Beck symmetricals working at $f/8$, the price is £18 17s 6d. One point which should not be overlooked is the ingenious stereoscopic division, which is made in two parts, hinged top and bottom, and thus lies perfectly flat out of the way when the camera is being used for panel or postcard pictures. The "Lizars'" reflex, we should say, is now made with rotating in place of a detachable reversing back, and a locking device is provided whereby the shutter cannot be wound if the mirror is up.

THE "VOIGTLÄNDER" ENLARGING AND PROJECTION LANTERN

(Made by Voigtlander and Sohn, 12, Charterhouse Street, London, E.C.)

There is nothing extraordinary in the design of this apparatus, which consists of a Russian iron lantern body of ample size attached to a bellows front supported on a pair of draw-out tubes. But the apparatus is thoroughly well made, both optically and mechanically. The condensers (16 cm diameter, equal to 6½ ins.) are placed outside the lantern, and are provided with proper ventilation; they are of almost colourless glass, and of focal length to suit the objective, and to thus obtain the highest efficiency of the illuminant, which can only result from a proper adjustment of objective to condenser. The lens panel is provided with a certain amount of vertical movement, 2½ ins., and with fine focussing adjustment, the rough focussing for size of enlargement being done by drawing out the supporting tubes, which work with great smoothness. The negative or lantern-slide is supported in a wooden carrier of the to-and-fro pattern, the inner frames of which are automatically raised from the carrier proper, so that they can be readily seized and removed. Complete with "Helios" 16 cm focus lens of $f/4.5$, rack and pinion mount, and set of Waterhouse diaphragms, the price of the apparatus is £16 10s.; without lens, £8 10s.

THE GOERZ PANTAR ANASTIGMAT.

(Made by C. P. Goerz Optical Works, Ltd., 1 to 6, Holborn Circus, London, E.C.)

This lens may almost rank as a novelty, since it is now re-introduced by the makers after a period of withdrawal, owing, we learn, to the difficulty of obtaining glass of a sufficient degree of perfection. Incidentally, a higher degree of correction has been reached, which is saying a good deal, since our tests of the first issue of the lens showed it to be an instrument of remarkable qualities. The single combinations of the Pantar are made at the

aperture of $f/12.5$, and are obtainable in the focal lengths of 6, 7, $9\frac{1}{2}$, $11\frac{1}{2}$, 14, $16\frac{1}{2}$, and 19 ins. These are priced (in mount) at from £4 to £10, or unmounted from £2 15s to £8. The most convenient form, however, in which to purchase the lens is in a set, of which we may take the half-plate as an example. It consists of single combinations of $9\frac{1}{2}$, $11\frac{1}{2}$, and 14 in. focal length (of aperture $f/12.5$), the combinations of which in pairs give the following doublets:—

Combination $11\frac{1}{2} \times 9\frac{1}{2}$ resulting focus 6 in. ... $f/7.2$

Combination 14 $\times 9\frac{1}{2}$ resulting focus $6\frac{1}{2}$ in. ... $f/7.7$

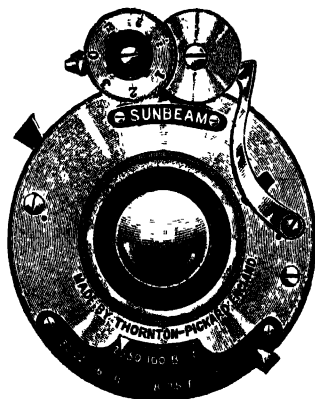
Combination 14 $\times 11\frac{1}{2}$ resulting focus $7\frac{1}{2}$ in. ... $f/6.8$

The price of the complete set is £13 10s., that for a quarter-plate being £10 5s., and for whole-plate £20 15s.

THE "SUNBEAM" SHUTTER.

(Made by the Thornton-Pickard Manufacturing Co., Limited, Altrincham.)

This between-lens shutter is of the convenient ever-set pattern to carry the two combinations of an R.R. lens, and is of a kind which has already achieved great popularity, but has hitherto been mostly obtained from American or German makers. In producing it the



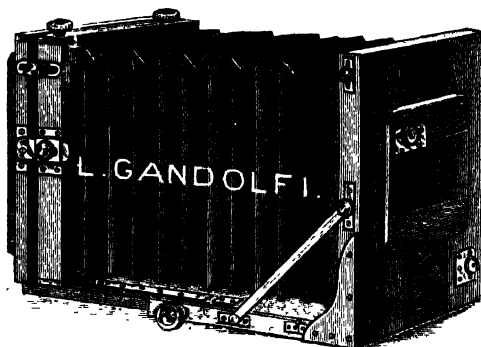
Thornton-Pickard Co. provide it with speeds marked at 1-25, 1-50, and 1-100; whilst for time and bulb exposures they also provide an automatic attachment for giving exposures of 1-10, 1-5, $\frac{1}{2}$, 1, 2, and 3 seconds. The shutter will take lenses up to 1 in. diameter, and is itself of the very small dimensions of $2\frac{1}{2}$ in. diameter. Its retail price is to be about £1.

THE "UNIVERSAL" CAMERA.

(Made by L. Gandolfi, 752, Old Kent Road, London, S.E.)

This very substantial model of a field camera, suitable also for studio work, is made by Mr. Gandolfi in five sizes from half-plate to 15 x 12, the 10 x 8 size before us having an extension of 26 ins.

The camera is of the hinged back base-board type, permitting of full side-swing and swing-back, and of the base-board being folded back as a protection for the focussing screen. The workmanship both of camera and slides, is very thorough, and, particularly in the



brass-bound pattern, the camera should serve for the very hardest wear. The price of the whole-plate size, brass bound and complete with three slides and two lens boards, is £3 6s

THE WATKINS BEE METER AND COMPASS.

(Made by the Watkins Meter Co., Imperial Mills, Hereford.)

The combination of the popular Bee meter with a compass in such a way as scarcely to increase the size of the instrument should surely be appreciated by photographers, who can often make good use of the latter accessory. A knowledge of the compass bearings will often enable the photographer to predict with certainty when the sun will be in the position to give the best lighting. A record of the point to which the camera lens points will be of assistance in obtaining a second negative of clouds for printing purposes, while in record work of any kind compass bearings are necessary to make the record complete. In addition to all this, the use of a compass in finding one's way about a strange country is obvious. The price of the "Bee Compass-Meter" is 3s. 6d.



THE "CRAIG" AUTOMATIC ENLARGER

(Made by Houghtons, Limited, 88 and 89, High Holborn, London, W.C.)

This combination of an enlarging lantern, easel, and baseboard is provided with a strongly made movement by which the lens is racked

out from the negative in order to keep the picture sharp as the easel is racked inwards towards the lens. There is thus no adjustment necessary beyond that determining the size of the enlargement, which is conveniently done owing to the marking of the easel board into the standard sizes. The apparatus is most substantially made, extends at the full 4 ft., but folds up when not in use to half its length. The negative stage is provided with detachable carrier, which allows of the negative being inserted at an angle, the lens has rise of front, and the easel takes the convenient shape of a frame with glass front and hinged back, into which the bromide paper is quickly inserted and kept in position by the spring back. The price of the whole outfit complete, with $5\frac{1}{2}$ -ins. condenser and Aldis lens working at $f/6$, but without lamp or gasburner, is £10 10s., if to enlarge to 15×12 . If to take paper up to 20×16 , and with $8\frac{1}{4}$ -ins. condenser the price is £15 15s.

RODENSTOCK'S "HELIGONAL" ANASTIGMAT

(Sold by Charles Zimmermann and Co., Limited, 9-10, St. Mary-at-Hill, London.)

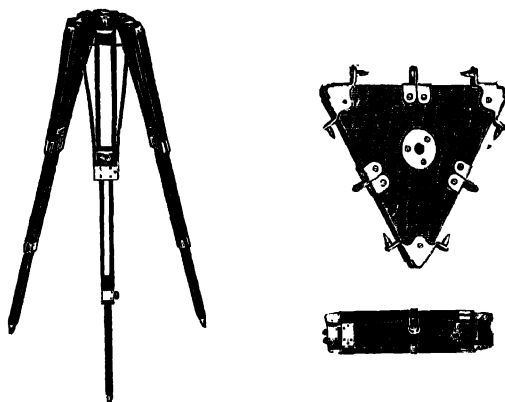
This is a very rapid anastigmat of fine quality, the specimen submitted to us being No. 5 of $8\frac{1}{4}$ ins. focal length and aperture $f/5.7$. On a half-plate this lens behaves admirably, and shows no trace of astigmatism at full aperture. The single combination is also an anastigmat, and works well at an aperture of $f/12.5$. The complete combination in the specimen we have tested shows a little spherical aberration at the largest aperture, but this quite disappears at about $f/6.5$, at which aperture the lens stands the most critical tests. Only a careful test on a small point of light will reveal the aberration, which is of a kind not at all likely to affect the sensitive plate. The "Heligonal" is an unsymmetrical doublet, the front combination being composed of two lenses only, while the back one has four. The iris is of metal, and the workmanship and finish are excellent. The price of the No. 5 in ordinary mount is £8. A $4\frac{3}{4}$ -in. lens suitable for a $\frac{1}{4}$ -plate camera works at $f/5.4$, and costs only £4—from which fact it is evident that the "Heligonal" is not overpriced. We may indeed style it a cheap lens, considering its fine quality and its universal utility.

THE ASHFORD "NATURALISTS'" STAND

(Made by J. Ashford, 179, Aston Road, Birmingham.)

A dwarf model of the well-known and most rigid Ashford stand has been brought out under this title. The length of the leg fully extended is 29 ins., the tripod folding to a total length of $13\frac{1}{2}$ ins. The top is a triangle, each side of which is 6 ins., and the apparatus is thus very suitable for supporting cameras such as are used for

photographing still-life subjects, animals, etc., as a point of view only 12 inches from the ground can be taken. Each leg is



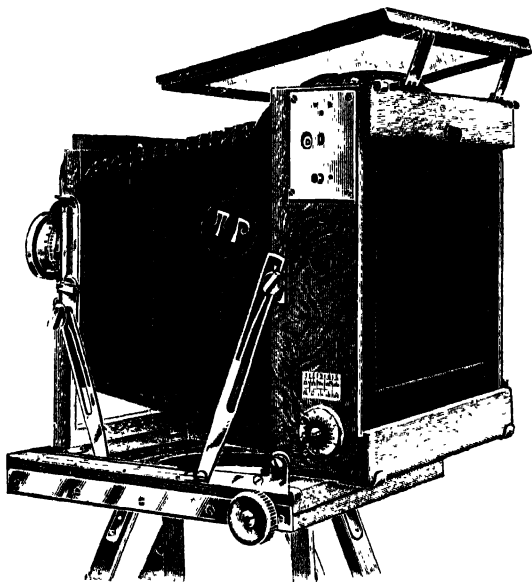
rapidly closed by simply pressing it upon the ground. The price of the stand complete with strap is 14s. 6d.

THE "IMPERIAL" TRIPLE-EXTENSION CAMERA.

(Made by the Thornton-Pickard Manufacturing Co., Limited, Altrincham.)

In the latest model of this stand camera the Thornton-Pickard Company have made improvements which give a still further range of movements to the camera, and fit it still more for all descriptions of photography. The chief item is in respect to the focal-plane shutter, which is now made with two slits, the use of one or other of which, in conjunction with the series of five tensions of the actuating spring, gives a series of exposures from 1-25th to 1-1000th of a second. The change from one slit to another is very conveniently made, and the shutter also automatically opens itself to full aperture for focussing. All the adjustments are made from the outside of the camera and the facility which the possessor of this apparatus thus has in photographing the most rapidly moving objects makes the apparatus of universal application. In other respects the camera is an improvement on last year's model, particularly in the front, which works entirely in brass struts, and gives a very great rising movement of the lens. The camera has the necessary wide-angle movements and a maximum extension of 22 ins., is fitted with swing-back, rotating turntable, and, like other manufactures of the Thornton-Pickard Company, is produced with

a regard for convenience and rapidity in use. The price of the apparatus in the half-plate size, complete with focal-plane and



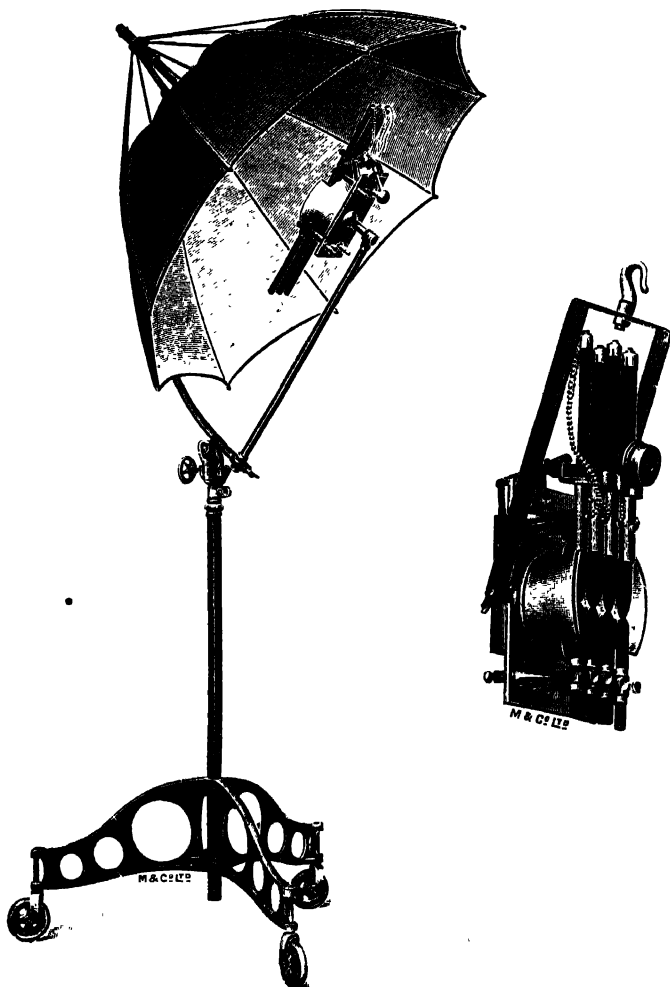
Thornton-Pickard roller-blind shutters, tripod, one double dark-slide, and Beck lens is £5 10s.

THE "BOARDMAN" MULTI-CARBON ARC LAMP.

(Made by Marion and Co., Limited, 22 and 23, Soho Square, London, W.)

Messrs. Marion, who have established an electrical department under the direction of Mr. F. R. Boardman, well known as the manufacturer of photographic lamps, have issued a new pattern of lamp, in which the principle of light reflected from an umbrella, which has hitherto been found to give the finest results, is adopted, in conjunction with certain improvements which make the apparatus still more efficient. The hood is made collapsible, so that the whole apparatus can be taken in a cab for artificial-light work away from the studio—e.g., at theatres, dances, etc. The simplest form of lamp, and that recommended by the makers, is the hand-feed, the price of an outfit of which, as shown in the illustration, is £17 11s. Automatic feed of the lamps is also obtainable at a slightly increased price, but in studios, when it may be necessary to do without any electrical assistance, the hand-feed is preferable on account of its great reliability in action. The lamp is fitted with an improved type of carbon, giving a greatly increased actinic quality

of the light, and the lamp—which, it should be said, is obtainable separately—may be used on voltages of from 200 to 250 in the case



of the 4-arc and 5-arc lamps, which are those most suitable for the highest class of studio work, and are best adapted for the generality of the current supplied by the electrical companies.

RODENSTOCK'S UNIVERSAL "IMAGONAL" SET.

(Sold by Charles Zimmermann and Co., Limited, 9-10, Mary-at-Hill, London.)

Two sets of these convertible lenses are made, No. 1 being designed for half-plate work and No. 2 for whole plate. No. 1 is the set we have tried, and its cost, £7 10s., cannot be considered excessive, seeing the wide scope covered by the various combinations. All the changes are made at the back of the objective, and to facilitate matters a so-called "rapid mount" is employed; instead of a screw, a very ingenious kind of spring bayonet joint is fitted. This applies both to the flange and to the back combination, and as a result any required change can be effected in a few seconds. Four back lenses are provided, and with these the following doublets can be formed, each of which fully covers a half-plate:—A wide angle of 5½ in. focus and aperture $f/15$, a 6 in. of $f/10$, a 7 in. of $f/6.8$, and a 10½ in. lens of $f/12$ aperture. All these doublets are anastigmats, and tests show that they are anastigmats of good quality, though not absolutely free from astigmatism like the "Heligonal" doublet. The front combination, used alone, gives what the makers describe as a portrait lens of 8¾ in. focal length, while if this front combination is unscrewed and the back lenses alone used, then "landscape" lenses of 9½, 12½, and 18½ in. focal length are obtained. All these single lenses are supposed to be used at $f/31$, but larger apertures are available, and may be useful in many cases. The set is put up in a very neat case, carrying also two filter screens, fitting into the back lenses, together with a table of stop values and exposures. It will be noted that the most rapid combination is one of 7 in. focus and $f/6.8$ aperture. This is a very useful type of lens for a half-plate camera, and this particular "Imagonal" is a good anastigmat suited to all kinds of work.

THE "ELIPSOID" "A" PATTERN ENLARGING LANTERN.

(Made by J. Lancaster and Son, Limited, Camera Buildings, Broad Street, Birmingham.)

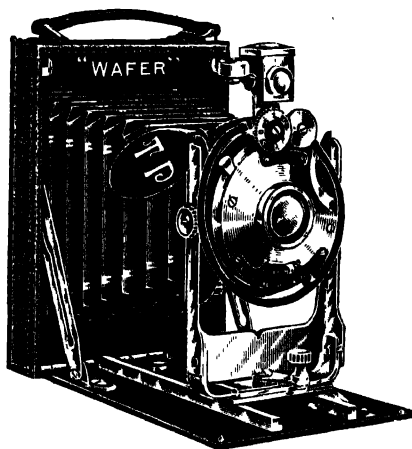
In the most recent pattern of this lamp for enlarging without a condenser and using the photographer's own camera an inverted incandescent mantle is employed, with special outside attachment for the regulation of the air supply. The lamp provides a strong and even illumination of the negative, and can be obtained of sizes suitable for negatives from quarter-plate to whole-plate size, at prices from 10s. to 21s.

THE "WAFFER" CAMERA.

(Made by the Thornton-Pickard Manufacturing Co., Limited, Altrincham.)

Under this title the Thornton-Pickard Co. are themselves manufacturing in their factory a series of folding cameras of very slim dimensions. They are issued in quarter-plate and postcard sizes, that before us being the postcard single extension sold at £2 17s. 6d. For this we obtain an instrument with good rise and cross motion of front, reversible brilliant finder and level, R.R. lens fitted with the "Sunbeam" between-lens shutter (noticed elsewhere), and two single metal slides. The very small dimensions of the camera when

closed—namely, $5\frac{3}{4} \times 4 \times 1\frac{1}{4}$ ins.—make this pattern of instrument a suitable one for the pocket. The quarter-plate size is sold at £2 12s. 6d.



The double extension "Wafer" has, in addition to the above movements, a swing-back and valve adjustment for the shutter, and is made in quarter-plate size at £4 4s., or postcard, £4 10s.

The Thornton-Pickard Company are also issuing a series of roll-film folding cameras, manufactured in their factory at Altrincham, and to appear on the market early next season. These are to embody the features which have been found most advisable in cameras of this class, and are to be marketed under the name of "Sunbeam." The full specification of the cameras will be found in the company's circulars.

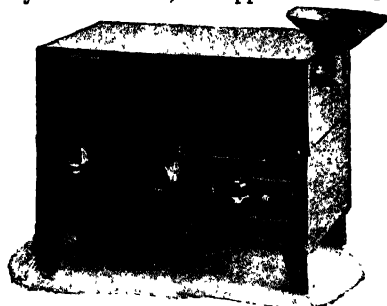
A DEVELOPMENT ACCESSORY FOR AUTOCHROMES, PANCHROMATIC PLATES, ETC.

(Sold by R. and J. Beck and Co., Limited, 68, Cornhill, London, E.C.)

This piece of apparatus consists of a light-tight metal box, through the corner of which water or any solution can be introduced by a funnel, whilst the bottom of the box is made double—to act as a light trap—and permits of any solution being discharged from the apparatus while the latter is in use. In the chamber itself is a platform on which a dish can be laid, the metal floor of the platform being turned up all round so as to retain the dish in position. The platform is mounted on an axle, which is continued through one side of the box, and there provided with a pin, which passes through its extremity, and is stopped by two other pins fixed to the side of the box. This simple mechanism thus allows of the platform being given a see-saw motion within various limits—that is to say, the developing or other solution in the dish is gently rocked to and fro. One of the stop-pins, however, can be pulled out of the range of the

moving pin, and the platform can then be tipped so far over that the solution is all discharged from the dish and escapes from the false bottom of the box down the sink, or into a larger dish, in which the box may be placed.

As supplied by Messrs. Beck, the apparatus is well made in Ger-

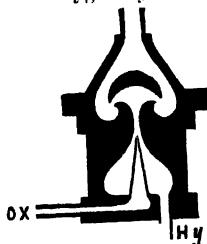


man silver, and should certainly be a most useful accessory in the development of both ordinary and colour-screen panchromatic plates. Its price in quarter-plate size is 25s. It is obtainable also for 5 x 4 and half-plate, prices, 30s. and 37s. 6d. respectively.

THE HUGHES INJECTOR JET.

(Made by W. C. Hughes and Co., 82, Mortimer Road, Kingsland, London, N.)

A limelight jet constructed on the injector principle, in which the stream of oxygen serves the purpose of drawing the supply of coal-gas into the mixing chamber, is a new introduction of Messrs. Hughes. It thus provides the means of using a mixed jet with only the oxygen cylinder, and, when employed with an ordinary regulator, is constructed to consume only 3 feet of oxygen per hour. The jet is preferably employed with reducing valves instead of a regulator, the valves being used on the jet itself, so that a much finer adjustment of the gases is possible. The lime pin has two movements from the one rod—namely, up and down and to and from the nipple. No wiring on of the supply tubes is necessary, and the jet is certainly an excellent tool for the amateur or professional lanternist. Its price is 30s.

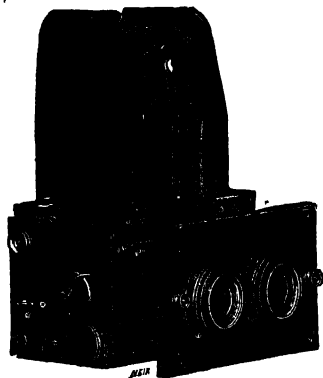


THE "HELIAE" 3½ in. x 2½ in. AND STEREO REFLEX CAMERAS.

(Made by Voigtlander and Sohn, 12, Charterhouse Street, London, England.)

In adding a camera smaller than quarter-plate to the series of "Heliar" reflex instruments the firm of Voigtlander, we think, has shown that it fully realises the advantages of the reflex type of instrument, and our own experience certainly leads us to the opinion that for a small tourist instrument the 3½ ins. x 2½ ins. size is preferable to the quarter-plate. The only condition which becomes even more stringent in the case of a small reflex camera is accuracy of

workmanship, the smaller working parts calling for still better workmanship. In this respect it is impossible to find fault with the "Heliar" camera, which mechanically is a beautiful instrument, and most convenient and rapid in practical work. For the $3\frac{1}{2}$ ins. x $2\frac{1}{4}$ -in. plate a "Heliar" lens of $4\frac{1}{2}$ ins. focus is fitted, and the total extension from focussing-screen to lens panel is 8 ins. Complete, with its lens and three double dark slides, the camera costs £16 5s., or for £19 5s. is sold with one of the Voigtlander telephoto attachments, giving $2\frac{1}{2}$ times magnification, and thus permitting long focus pictures to be obtained at a working aperture of no greater than $f/11$.



The "Heliar" stereo-reflex is still another size of this high-class instrument, being made for a plate 10.7×4.5 cm., or $4\frac{1}{4}$ ins x $1\frac{1}{2}$ ins. It has all the adjustments of the other sizes, in addition to a simultaneous adjustment of the iris diaphragms and fixed stereoscopic division in the camera. The price complete, with a pair of "Heliar" anastigmats of $f/4.5$ aperture and 85 mm. focal length, with three double dark slides, is £20.

THE BUSCH "LEUKAR" ANASTIGMAT.

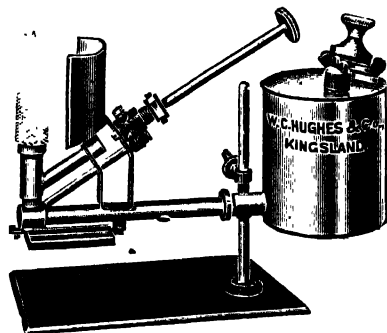
(Sold by the Emil Busch Optical Co., 35, Charles Street, Hatton Garden, E.C.)

This is a symmetrical double anastigmat of $f/6.8$ aperture, and of very small and compact form. The No. 2, which is between $5\frac{1}{2}$ and $5\frac{1}{4}$ inches in focus, will cover anything up to 7×5 . Thus, while it is listed to cover a $\frac{1}{4}$ -plate sharply at full aperture, we find it gives very good results on a half-plate. The complete doublet is an excellent lens for general work, and the price, £3 15s. for the No. 2, is certainly moderate. The corrections seem to be very good, and the single combination also serves well as a narrow angle long focus objective. "Leukar" lenses can be obtained in three varieties of mount—a plain iris mount, a focussing mount, and a "sunk mount," with which the flange comes at the front of the lens. The focal lengths vary from $2\frac{1}{4}$ to 18 inches, so there is a wide range to select from. "Leukars" are also supplied in Unicam, Automatic, or Koilos shutters, and a No. 2, in Koilos shutter, only costs £5 10s.

HIGH PRESSURE SPIRIT LAMP.

(Made by W. C. Hughes and Co., 82, Mortimer Road, Kingsland, London, N.)

This convenient type of illuminant for projection and enlarging purposes is made by the well-known lantern firm of Hughes and Co., substantially in brass and with convenient adjustment for regulating the supply of spirit. The light which it gives is a most intense one, and the occasional working of the pump to ensure sufficient pressure is quite conveniently done owing to the proce

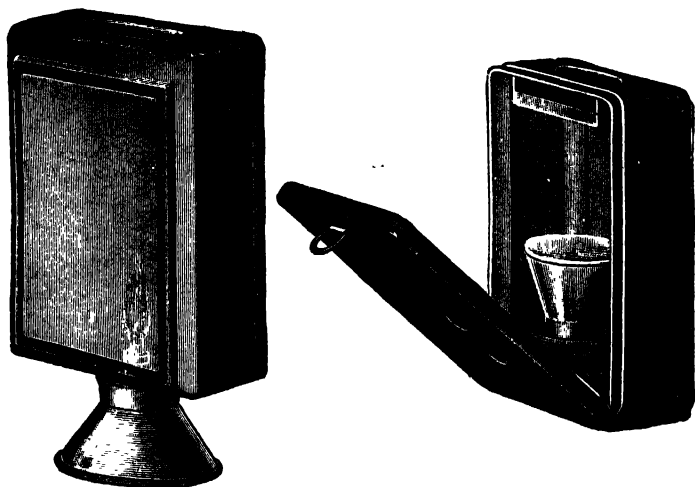


tion of the spirit reservoir from the back of the lantern. Ready for attachment to an ordinary lime-tray, the price of the lamp is 35s.

THE "MINIMUM" POCKET RUBY LAMP.

(Sold by W. Butcher and Sons, Ltd., Camera House, Farringdon Avenue, London E.C.)

A portable ruby lamp, which is sufficient for changing plates or when developing a plate or two en route, is a most useful addition to the tourist's outfit, and it cannot be said that much choice is offered in the purchase of such an accessory. Messrs. Butcher, in the new apparatus before us, have certainly reduced the size of the lamp to the minimum proportions, and have given their introduction a form which should appeal to the tourist. For the little apparatus is entirely self-contained, and though the size of the glass is not great ($2 \times 2\frac{3}{4}$ in.), the illumination is sufficient for the nightly changing of one's plates. The lamp consists of a small metal box, $2\frac{1}{2} \times 3\frac{1}{2}$ in., which throughout is riveted together, and is provided with trapped inlet and outlet for ventilation. The illuminant is a small lamp burning benzoline, the tiny reservoir being supplied with sponge which is only to be saturated with the benzoline when using the lamp. The reservoir, as shown in the second illustration, packs within the lamp when travelling, and the whole apparatus can be put away among other luggage without fear that it will leak or



communicate grease to any clothing with which it comes in contact. The price of the "Minimum" pocket lamp is 2s. 6d.

THE "DIAMOND" $3\frac{1}{2} \times 2\frac{1}{2}$ FOLDING CAMERAS

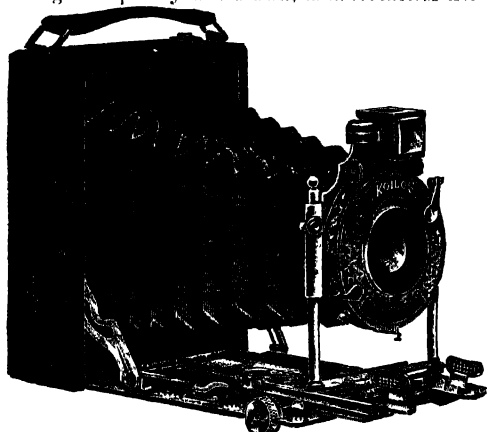
(Made by Emil Wunsche, A. G., Dresden, and 24 and 26, Holborn, London, E.C.)

These two series of cameras are of the $3\frac{1}{2} \times 2\frac{1}{2}$ size now growing into popularity for lantern slide and enlargement work. The first (No. 913) is sold at the figure of 25s. only, and is a neat little instrument and wonderful value for the price. The baseboard falls down on pressing the release, and the front is then pulled out instantly for the position for distant objects, so that the time of preparing the camera for use is a few seconds only. The camera has rising and cross-front motion, reversing brilliant finder, an automatic shutter, with finder and pneumatic release for time and instantaneous work, and a single achromatic lens working at apertures from $f/11$ to $f/44$. When folded the instrument measures $4\frac{3}{4} \times 3\frac{1}{2} \times 1\frac{1}{2}$ ins., and carries focussing scale for objects up to 3 ft. distant.

The second model, that shown in the drawing, similarly extends automatically to the position of focus on distant objects, but is fitted with rack and pinion adjustment and focussing scales for both the complete lens and the single component. It has a reversible level in addition to the finder, and is fitted with R R lens working at $f/8$ and mounted in the "Koilos" sector shutter. Both cameras are provided with bushes for attachment horizontally and vertically to the tripod, and both are also fitted with hooded ground glass for focussing when used in this way. The price of the "Diamond" de luxe (No. 915) is £2 2s.

We should call attention to the pattern of single metal slide supplied with the Wunsche cameras. It is fitted with a pair of clips which allow of the plate being released quite easily, and a further

novel feature is the hinging of the shutter to the slide so that the latter, although completely withdrawn, is nevertheless not detached

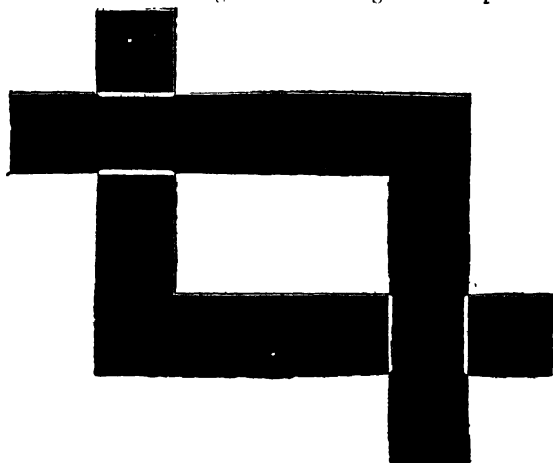


from the slide, but hangs down behind it until the exposure has been made. These slides are issued at the price of 1s. 6d. in quarter plate size, or 1s. 9d. in postcard, $5\frac{1}{2} \times 3\frac{1}{4}$.

THE "PRIMUS" COMPOSING GAUGE.

(Sold by W. Butcher and Sons, Ltd., Camera House, Farringdon Avenue, London, E.C.)

The old and useful dodge of discovering the best portion of a



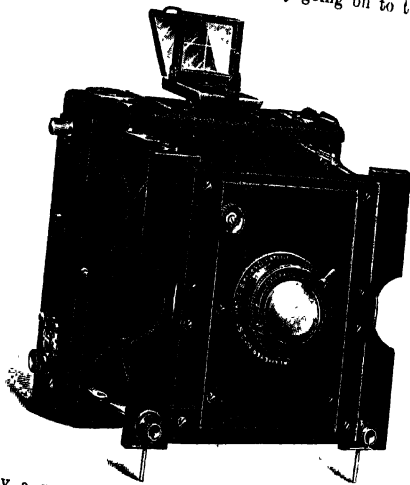
print by sliding two L-shaped pieces of card over it has been given

practical form by Messrs. Butcher, who supply it of size sufficient for prints up to $9 \times 6\frac{1}{2}$ in., and so fitted that the two pieces keep at right angles to each other. The price of the gauge is 1s. 6d.

THE "PENRIC" FOLDING FOCAL-PLANE CAMERA.

(Sold by J. H. Dallmeyer, Limited, Denzil Road, Neasden, London, N.W.)

This folding focal-plane camera is of substantial construction, and is fitted with focal-plane shutter provided with an adjustable spring tension to "slow" and "fast" which is used in conjunction with an alteration in the width of the slit, made as the shutter approaches the end of its wind. That is to say, the fastest speed is obtained by setting the shutter to the mark 1, whilst the slowest for this particular tension is obtained by going on to the mark 12.



In this way a range of speeds from 1-30 to 1-1,000 second are obtained. The shutter has also convenient time adjustment, and the camera takes a No. 2 Stigmatic lens, fitted with which its price is £13 13s. We should add that other varieties of this camera are made of the long extension necessary for use with the "Adon" lens at considerable magnification.

THE "ROYAL" REFLEX, 1909 MODEL.

(Sold by A. E. Staley and Co., 19, Tavies Inn, Holborn Circus, London, E.C.)

In the latest model of this reflector camera a more convenient release for the pulling out of the front to the double extension position is provided. It consists of a metal plate placed directly

under the lens panel. At its double extension position the front is remarkably rigid. Another new feature is the provision of an automatic diaphragm for the ground glass working in conjunction with the rotating back and showing the landscape or upright arrangement of the picture on the focussing screen according to the position of the plate. This should save any confusion in the selection of the picture. In other respects the camera has the good features of rapid wind and very gentle action of the focal-plane shutter. The price for the $5\frac{1}{2} \times 3\frac{1}{2}$ camera without lens, with improvements as stated, is £12. The camera when fitted with the $8\frac{1}{4}$ -in. "Nulli Secundus" lens in sunk mount costs £15 17s. 6d.; fitted with the *f*/6.8 Series III. Euryplan its price is £18 5s.; with the Series II. *f*/5.6 Euryplan, £19 10s.; and with Series I. *f*/4.5 Euryplan, £22 5s.

"EAGLE" AND "CONDOR" QUARTER-PLATE SETS.

(Made by the Camera Construction Co., Eagle Works, Durham Grove, Hackney, London, N.E.)

This London firm of camera makers have this season put out two models of quarter-plate camera which give the full range of movements at a moderate price, usually obtainable only in half-plate size. That is to say, long extension (in the "Eagle" of 18 ins. from plate to lens), wide angle movement of the back for the use of short focus lenses, swing and rising front, swing and reversing back, and rotating turntable top. The apparatus is well turned out, the adjustments convenient in use, and the whole outfit one which may be strongly recommended to those commencing photography with a quarter-plate. The price of the "Eagle" set, inclusive of R.R. lens, roller-blind, and time and instantaneous shutter, three-fold tripod, and one double slide, is £5 5s., or £3 7s. 6d. with Beck symmetrical or the firm's special Aplanat.

The "Condor" outfit is similar, but of double extension only, and is priced at the moderate figure of £2 7s. 6d., including two-fold tripod, R.R. lens, roller-blind time and instantaneous shutter, and one double slide. The quarter-plate worker should make a note of the excellent service done him, at a popular price, in these cameras.

THE "ARGUS" REFLEX 1909 MODEL.

(Made by W. Watson and Sons, Limited, 313, High Holborn, London, W.C.)

In the new pattern of this instrument a direct racking out for the long extension has been adopted in place of the pull-out movement previously possessed by the camera. The shutter has also been modified, so that for alteration of the slit it is now only necessary to set the two outside levers to time, to wind the blind, release it into the open position, and then by pressure on the knob on the left-hand side of the camera the aperture can be opened or closed to what is necessary, and the shutter re-wound to be ready for use. The price of the camera, which, as before, is built to accommodate the single components of the "Holostigmat" lens, is £19 15s. in quarter-plate size when fitted with reversing frame, and including series I. "Holostigmat" and three double dark slides.

THE "PRESSMAN" REFLEX CAMERA.

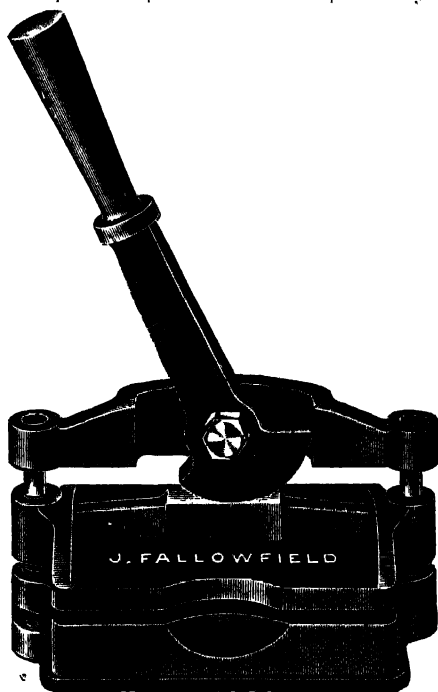
(Sold by W. Butcher and Sons, Limited, Camera House, Farringdon Avenue London, E.C.)

This reflex camera, made in the 5×4 size, has the long extension ($14\frac{1}{2}$ in.) necessary for photographing objects at a distance. It is fitted with a focal-plane shutter of the multiple-shut type, giving a range of exposures from 1-10 to 1-1000 second. The rotating back works in conjunction with a diaphragm the size and shape of the plate, and automatically shows on the focussing-screen whether the plate is in a position for upright or horizontal pictures. The hood turns back immediately from the focussing-screen, and the front is fitted with rack movement for rise and fall, of which there is a range of movement of 2 in. The mirror automatically returns to the down position after exposure, thus providing against accidental exposure of the plate. Complete with three double dark slides, sling strap (but without lens), the price is £14 14s.

THE "EMBOSSA" PRESS

(Sold by Jonathan Fallowfield, 146, Charing Cross Road, London, W.)

In this small hand-press, placed on the market by the firm of Fallowfield the postcard publisher in a comparatively small way

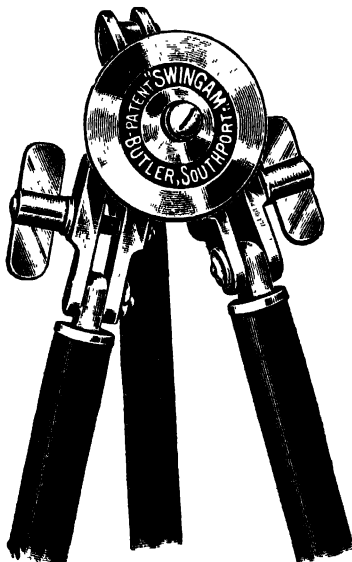


provided with the means of giving an enhanced appearance to his productions at a trifling outlay. The "Embossa" consists of a small lever press, which will take a mounted photograph up to $5\frac{1}{2} \times 3\frac{1}{2}$, the standard official postcard size. With the press are provided six sets of dies, giving plate marks of the following dimensions:—3 inches circle, $4\frac{1}{4} \times 2\frac{1}{4}$ oval, 3×2 oval, and rectangles $2\frac{3}{4} \times 4\frac{1}{2}$, $2\frac{3}{4} \times 3\frac{1}{2}$, and $1\frac{3}{4} \times 2\frac{3}{4}$. Any one of these dies, with its corresponding plate, is quickly inserted in the press and the two parts of the die brought into accurate register by means of the two pins shown in the drawing. After packing the die as may be necessary, according to the thickness of the card, a single smart turn of the lever will give to the postcard the desired plate mark. The form of the dies makes it easy to insert or withdraw the cards rapidly, and a boy or girl can thus give this finish to a photographer's own postcards at a small expense for labour. The price of the "Embossa" press is 17s. 6d.

THE "SWINCAM" TRIPOD. MODEL C (TOURIST) PATTERN.

(Made by William Butler, 20, Crosby Road, Southport.)

The new C pattern of the "Swincam" is offered in order to provide a tripod suitable for the amateur user, but offering practically



the same range of adjustments possessed by the original pattern. It is of the telescopic metal type, and the universal movements of the head are secured by two ball-socket attachments held in any position, each by a wing nut. The head itself is $1\frac{1}{2}$ inches in dia-

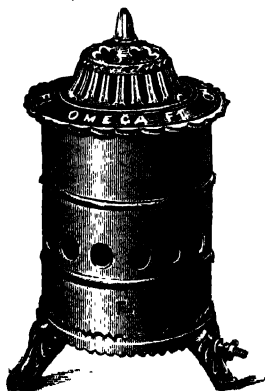
meter, and is fitted with English and Continental screws for attaching the camera, either of which can be used at option. The length of the thread projecting above the top of the head plate can be adjusted to suit different makes of cameras, or both screws can be removed and the hole formed in the centre of the head utilised for securing the camera by means of a T-headed screw, the links when placed at an angle to the legs affording space for handling the screw, and enlarging the base for the support of the camera.

The mechanical design of the apparatus is an excellent example of strength and convenience, and the rounded-off finish of the brass and aluminium work no small recommendation to the tripod. The total height at full extension is 4 ft. 2 in., whilst when closed the instrument measures 1 ft. 5 in. by 1½ in. over all. Its price is £1 1s., and for a further 5s. 6d. a neat leather sling case is supplied. It should be mentioned that Mr. Butler, who is an engineer holding a responsible post in the North of England, himself examines and adjusts each tripod before it is sent out, a guarantee, if any were needed, of the thorough workmanlike construction and finish of each instrument.

THE "OMEGA" STOVE FOR DARK-ROOMS.

(Sold by Alfred B. Allen, 20, Endell Street, London, W.C.)

The F 1 pattern of this very efficient stove, suitable for dark-room or studio, is made for a gas consumption of 10 ft. per hour at a pressure of 2 ins. and costs, finished in Berlin black, only 21s. 6d., from Mr. Allen, well known in his own business of repairs to apparatus and construction of special accessories and outfits. It stands



18 ins. high, is 15 ins. in diameter, weighs 21 lbs., and is advised for rooms up to 10 ft. square. A large number of other patterns are sold by Mr. Allen, who is prepared to fit them specially for any photographic purpose. The stoves are commendably free from the smell often associated with flueless gas stoves, and are recommended for the many purposes where gas can be used for heating.

THE "NULLI SECUNDUS" ANASTIGMAT.

(Sold by A. E. Staley and Co., 19, Tavies Inn, Holborn Circus, London, E.C.)

At its full aperture of $f/6.8$ the lens covers a half-plate perfectly to the extreme corners, a test which we were able to increase in severity by raising the lens nearly level with the top of the plate; the lower part was still satisfactorily covered. The lens, it is evident, has a very flat field, and is able to cover a plate considerably larger than that for which it is listed, and this without resorting to a small diaphragm. The lens is undoubtedly capable of very fine work over a large angle. The prices and sizes of the lens are as follows:—

No.	Focus.	F.A.	Size Covered.		Iris Mounts.
			Full Aperture.	Small Stop.	£ s. d.
0	4 $\frac{1}{2}$	$f/6.5$	4 $\frac{1}{2}$ x 3 $\frac{1}{2}$	6 $\frac{1}{2}$ x 4 $\frac{1}{2}$	3 10 0
1A	5 $\frac{1}{2}$	"	5 x 4	7 x 5	3 15 0
1	6	"	6 x 5	8 $\frac{1}{2}$ x 6 $\frac{1}{2}$	4 5 0
2	7	"	7 x 5	10 x 8	5 0 0
3	8 $\frac{1}{2}$	"	8 x 6	12 x 10	6 10 0
4	9 $\frac{1}{2}$	"	9 x 7	14 x 12	8 5 0

Figures which are moderate for a lens of the remarkably high quality of the "Nulli Secundus."

THE BECK TELEPHOTO SUPPORT.

(Made by R. and J. Beck, Limited, 68, Cornhill, London, E.C.)

A simple and very practical accessory for telephoto work is issued by Messrs. Beck in the form of an apparatus resembling an inverted tripod leg in appearance; that is to say, it consists of a pair of supports on which are mounted two sliding pieces, the upper one terminating in a spring clip to grasp the telephoto lens. The upper limb may be adjusted in height so as to accommodate the lens at any ordinary height of the camera, and the apparatus, as supplied, gives a total height of 4 ft. The use of a firm support for the telephoto lens is a great gain, particularly in high-power work. The present apparatus measures 25 x 2 ins. when closed, and may be strapped up with the photographer's ordinary tripod. The price is 7s. 6d.

AN ARC LIGHT REFLECTOR.

Made by David Allan, Whitfield Works, Mansfield Street, Kingsland, London, N.E.)

A dome-shaped reflector or umbrella, with white reflecting surface on the inside, is made by Messrs. Allan specially for use with arc lamps used in studio lighting. The reflector is mounted on a wooden framework fitted with pulleys by which the reflector can be raised or lowered. The price of the apparatus is £3 10s., exclusive of the stand, for which an extra charge is made. The diameter of the screen is 5 ft. 6 ins., and the depth 2 ft.

A RETOUCHER'S EYE-SHADE.

(Sold by T. S. Bruce, 4, Villas-on-Heath, The Vale, Hampstead, London, N.W.)

A very light and convenient shade for the eyes, supplied specially for the use of retouchers, fine-etchers, and similar photographic

workers, is about to be placed on the market by Mr. T. S. Bruce, at a price which will be about 1s. The shade is secured by an extremely light spring, and is so arranged that it touches the head of the wearer only at one point, allowing a current of air between the forehead and the shade, and thus making for coolness in use. The position of the shade can be instantly altered by a single touch. It is made in book binder's cloth.

THE "CHALLENGE" TRIPLE EXTENSION TROPICAL OUTFIT.

(Made by J. Lizards, 101 and 107, Buchanan Street, Glasgow.)

A brass-bound pattern of the excellent half plate camera issued for the home market at the popular price of 75s is made by Messrs. Lizards for £4 15s, inclusive of lens, time and instantaneous shutter, tripod, and double slide. The camera in its tropical edition is brass-bound and with the woodwork of teak. The great rise of front—3½ ins.—and the total extension of 24 ins., together with the wide-angle movement for the use of short focus lenses, render it an excellent piece of apparatus for the most varied descriptions of photography.

THE HYDE DRY MOUNTING MACHINE.

(Made by Hyde and Co., 33, Duke Street, Chester.)

A low priced but quite efficient hot press for the now almost indispensable dry-mounting process is made by Messrs. Hyde with a bed measuring 7 x 9 ins., the plate for which is brought down by a very strong and even cam-lever. The press is sent out complete, with two zinc plates, a thermometer registering from 120 to 300 deg., and a detachable brass atmospheric gas burner, which stands underneath the apparatus, and allows of very nice adjustment of the heat. The apparatus also includes a "toucher" for the attachment of the tissue to the print, and is sold for the price of 27s. 6d.

A FOLDING WOODEN TRIPOD.

(Sold by W. Watson and Sons, Limited, 313, High Holborn, London, W.C.)

A very light tripod of ebonised wood is newly supplied by Messrs. Watson at the price of 18s. 6d. Its length from point to tripod head is 4ft. 4in., conveniently providing for a height of the camera of 48in. The tripod is four-fold, is fitted with sliding legs, and packs up to a length of 17in. The price includes a waterproof case.

THE AGFA EXPOSURE TABLE.

(Sold by Charles Zimmermann and Co., Limited, 9 and 10, St. Mary-at-Hill, London, E.C.)

A card calculator, giving exposures for the six various brands of Agfa ordinary and orthochromatic plates, is sold for the sum of

one shilling. It provides for the usual variations, daily and yearly, of light, and for a wide range of subjects, and has a further novel feature in that it supplies the means of calculating the quantity of Agfa flash powder for use when using a lens of various apertures, and at various distances from the subject. Thus, for a subject at 10 yards from a lens working at $f/6$, the quantity of Agfa powder for a plate of 200 H and D, such as the Agfa extra rapid, is $2\frac{1}{2}$ gms.

THE BECK FOCUSING EYE PIECE.

(Made by R. and J. Beck, Limited, 68, Cornhill, London, E.C.)

A focussing magnifier mounted in aluminium and provided with a telescopic tube is a new form of this useful attachment, which Messrs. Beck have introduced at the price of 10s. 6d. The eye-piece is provided with screw movement for adjustment to various sights, and is as compact a form of the focussing magnifier as can be desired.

THE WATKINS SPECIAL BEE METER FOR AUTOCHROME PLATES.

(Made by the Watkins Meter Co., Hereford.)

In the "Colour Photography" Supplement for November 1, 1907, Mr. Watkins pointed out the inefficacy of improving actinometers used in autochrome work by employing orthochromatised paper in them. The result, he proved, would be to give indications still further wide of the mark, since such paper, exposed in weak indoor light, darkens relatively quicker, whereas the autochrome plate is found to require relatively more exposure in such circumstances. Mr. Watkins has now introduced a special dial which can replace the ordinary one in the Bee meter. It is engraved to make an allowance such that 128 times the exposure is given under conditions of small diaphragm or poor light which theoretically require but 64 times, and other similar allowances are made in geometric ratio. We have found the meter most reliable in use.

The following are the instructions for use with the meter:— Calculate with the same speed number for all lights and subjects, except that when time is calculated in minutes, instead of seconds, half the speed number must be used. The usual speed number is 2; but this should be modified if found desirable, 3 being preferred by some. With autochromes the rule seems to be to test the best light falling on the subject, and to ignore the illumination of the shadows. Set the stop used against the speed number, and then against the light value (expressed in seconds), the exposure (in seconds) can be read on the outer scale. If a smaller stop than $f/11$ is used, it is possible that the exposure scale will not be extended far enough. In such a case calculate with one-quarter the light number, and give five times the exposure indicated opposite it. When judging whether a finished plate is rightly exposed, note that over-exposure

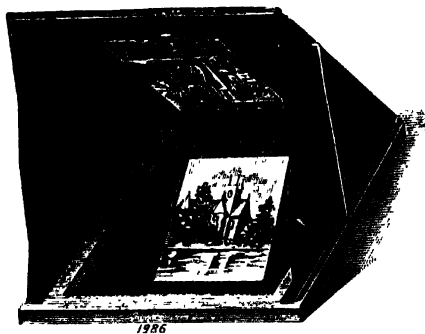
gives the thinnest image, and under-exposure the densest, thus reversing the usual rule for negatives. Be careful not to mistake under-development for under-exposure. The two and a half minutes for the first development is only right at the temperature named, and must be increased (up to five minutes) for cold weather.

INDOOR WORK.—It is necessary to take the actinometer time in minutes, and to read the required exposure also as minutes. When this is done the speed of the plate must be taken as half its usual value. Thus if the usual speed is 2, it must be taken as 1 (note that if 3 is the usual speed, its half value on the outer scale is $\frac{3}{2}$, not $1\frac{1}{2}$).

THE "ENSIGN" VIEWING STAND FOR AUTOCHROME TRANSPARENCIES.

(Made by Houghton & Co., Limited, 88-89, High Holborn, London, W.C.)

Makers of autochromes will be quick to appreciate the ingenious design of this apparatus, in which the autochrome can be fitted and more conveniently viewed than by holding it up to the sky or to any source of light. In the "Ensign" frame it is not the actual autochrome which is viewed but its reflection in a mirror. The advantage of this plan is threefold. In the first place, the observer looks down in comfort instead of craning his neck back-



wards; in the second place, it is impossible to scrutinise the autochrome too closely, and therefore the grain and banding, which can be seen in some examples of the Lumière process, cannot mar the effect of the picture; and, lastly, the colour rendering, when an artificial light is used, is most distinctly better than when the autochrome is viewed directly. With daylight the picture obtains extra brilliance when its reflection is observed, but by gas or electric light there is also a noticeable improvement in the colour rendering, due, we imagine, to some absorption by the mirror of the predominant yellow in the light.

The convenient way in which the stand is placed on a table and the picture examined just as one would a book lying on a table, is certainly a great point in favour of the apparatus. The stand is supplied in quarter-plate, lantern size, 5 x 4, and half-plate, in each case with rotating carrier, for horizontal and upright pictures, and with ground glass for use when employing artificial light. The prices of the frames are 4s. 6d., 5s. 6d., and 7s. 6d.

THE "TRESS" ELECTRIC DARK ROOM LAMP.

(Sold by the Tress Co., 4, Rathbone Place, Oxford Street, London, W.)

This very convenient dark room lamp takes the form of a board on which are mounted holders for two electric incandescent lamps, the current for which can be switched from one to the other by turning a lever affixed to the board. Three lamps are provided—namely, ruby, yellow, and white—so that the worker who, say, is doing bromide printing can instantly change from yellow to white, whilst in the case of development of plates the same change from ruby is obtained. The lamp is sold complete with adapter which will fit any electric incandescent holder. The price is 12s. 9d., and the lamp is supplied to suit any desired voltage, which latter should be stated when ordering.

THE "TRESS" AIR-BRUSH PUMP.

(Sold by the Tress Co., 4, Rathbone Place, Oxford Street, London, W.)

This hand reservoir pump is supplied for use with any make of air-brush, and is solidly constructed in brass and japanned metal, is mounted on a wood base, and is fitted with a device so that the pressure required to force down the piston does not become unduly great as the reservoir attains its full pressure. The price of the pump is 21s.

THE "TRESS" PORTRAIT ARC LAMP.

(Sold by the Tress Co., 4, Rathbone Place, Oxford Street, London, W.)

A self-contained two-carbon arc lamp suitable for studio portraiture of single figures or small groups is supplied by the Tress Company at the very moderate charge of 47s. 6d. It is a hand-feed lamp, the adjustment of the carbons being made very conveniently while the lamp is in actual use. It is suited for either a direct or alternating current, and is supplied complete with resistances adapting it for any voltage. We were able to prove to our own satisfaction that with a lens aperture of $f/8$ and a plate of medium rapidity the lamp gave an excellently exposed negative in two seconds. A stand for holding it is an extra accessory, and is supplied complete with universal ball head for 12s. 9d., at which price also a similarly constructed diffusing screen is supplied. The lamp is made to work with 10 ampères of current.

THE SELF-PORTRAIT LENS CAP.

(Sold by Nightingale and Co., 29, Nassau Street, Mortimer Street, London, W.)

A most simple attachment for the lens is sold under this name to enable the photographer to expose the lens by means of a thread when at a distance from it, either for self-portraiture or for other purposes. The shutter is fitted with a spring ring, which is attached to the hood of the lens, or, in the case of a box camera, where there is no hood available, to a rim which can be fixed to the camera front. The cap is fitted with a spring in such a way that on being opened by drawing the thread it closes itself again on the pressure being released, and this whatever position it occupies on the lens hood, so that the operator can work it from any point he pleases. The accessory is recommended by the makers as a means of studying portraiture in ordinary rooms and in different lightings without the photographer needing to inflict his efforts upon any other sitter than himself, to which end a manual, published separately at 1s., is included with the cap. The accessory should be useful not only for this purpose, but for enlarging and copying cameras, or in lantern-slide making when it is not always possible to get near enough to the lens to uncover it—for example, in signetting enlargements or in shielding certain portions of a picture when copying. The price is 5s., and the cap is made in three sizes, suitable for lens hoods from about 1 to $1\frac{1}{2}$ ins. diameter.

THE "FINSBURY" HEAD REST AND SCREEN.

(Sold by O. Sichel and Co., 52, Bunhill Row, London, E.C.)

The 'Finsbury' head rest is a commendable variant of the old-fashioned clamp for the human head, in that it provides simply a small surface, against which the sitter can be placed and does not, by its appearance and application, convey the pleasing sensation that the operator is planning a new method of garotting or some other form of sudden death. The "rest" is inoffensive to look at, but the chief point in its favour is the flexible adjustment by which it is placed anywhere without turning a single screw or using a clamp of any kind. The rest is attached to a support composed of a spirally constructed tube, something after the manner of the flexible gas tubing now in common use. In practice the device is most convenient. A touch, and the "rest" is placed where it is wanted without, as we have said, any fixing whatever. The apparatus is sold at 35s.

The head screen is on the same principle. Like the head rest, the inclination of either of the two screens can be separately altered by the same spiral tube construction. The height of the screens from the ground is also separately adjustable by a quick-movement clamp. Both pieces of apparatus have a smartness of appearance and certainly represent the acme of convenience in use. The price of the head screen is 50s.

THE TYLAR LENS HOOD.

(Sold by W. Tylar, Limited, 41, High Street, Aston, Birmingham.)

A useful accessory, particularly when using lenses of large aperture, is a leather pleated hood sold by Messrs. Tylar. It folds up to a length of $3\frac{1}{2}$ inches, and provides a hood which can be fitted



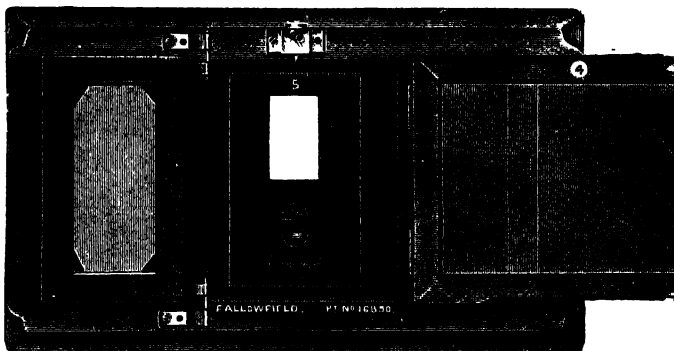
to lenses up to 2 inches diameter. When at its full extension it gives a circular shield 3 inches deep and 4 inches diameter..

THE "MULTISECTO," NO. 2.

(Sold by Jonathan Fallowfield, 146, Charing Cross Road, London, England.)

Last year we reviewed the new repeating back introduced by the firm of Fallowfield primarily for attachment to a studio camera, and we then expressed our good opinion of the facility afforded by it for the making of midget and other small-sized photographs, on plates of the standard sizes. The success of the apparatus is no doubt the cause of "Multisecto No. 2," which is destined to perform a similar duty not only in the studio but afield, inasmuch as it is made for fitting to an ordinary half-plate camera. In taking it into use it replaces the reversing back, and in the case of three types of camera—the Fallowfield "Alacrity," the Thornton-Pickard "Imperial," and the Houghton "Victor's"—nothing more is necessary than to detach the reversing back and place the "Multisecto" in position. The dark-slide of the camera equally fits into the groove of the "Multisecto." Practically any half-plate camera will carry the "Multisecto" after a trifling adjustment. In ordering the reversing back and a dark-slide should be sent to ensure correct cutting of the

apparatus. Those who have seen the older model or descriptions of it need not be told that the principle of the apparatus is the use of a "Secto," or mask, which is placed in the proper position by means of a notched bar, adjusted from outside the camera. By this means, once the subject has been focussed the whole series of ex-



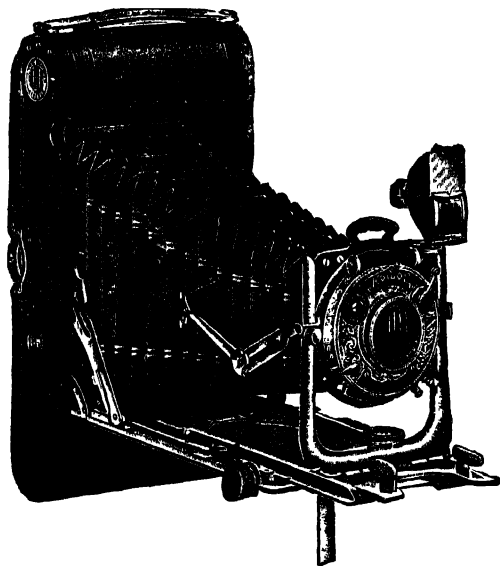
posures on the one plate is made without inspecting the ground glass, and the division of the plate is done very accurately and quite automatically. In some respects the No. 2 pattern is an improvement on its predecessors. For example, some "Sectos" are fitted with sliding panel, as shown in Fig. 1; each row of pictures thus commences at the same level. The modus operandi is as follows:—When a photograph is required, say, with No. 5, which takes ten midget pictures on a half-plate, the No. 5 "Secto" is put in position, and the subject correctly focussed on the screen, the notched bar No. 5 is placed between the grooves, and the slide is pushed along to the first catch-point, when the slide may be pulled partly out, then the spring bolt should be allowed to lock in the first hole and exposure made, and a further notch given till five movements and exposures have been made. Care should always be taken to see that the shutter of slide clears by a few inches the end of the "Multisecto." After five horizontal moves the slide is pushed clear of the "Secto," and the space altered to the bottom, when the camera is tilted or lens lowered, so that the subject to be taken will again appear in the focussing screen, and the operation is repeated. When once the idea of the movements has been obtained, the "Multisecto" will be found extremely easy to work; each "Secto" follows the above operation, but each has different moves; nos. 13, 18, 19, and 20 move horizontally, so that it is only necessary to focus once. Not only for portraits, but for landscape work, and particularly for making the most of Autochrome plates, the new "Multisecto" should be a most useful and popular instrument. As supplied by Fallowfield's, the size of the pictures can range from 3 x 2 inches to 1½ x 1, a total number of eleven different shapes being obtainable.

That is to say, the worker can ring the changes from eighteen pictures on his half-plate to two only. The price of the 'Multisecto' itself, with nine "sectors," and a set of notched guide-bars, is 60s.

THE "DARLING" (NIXE) 1909 FOLDING CAMERA.

(Made by Emil Wunsche, A.G., Dresden, and 24 and 26, Holborn, London, E.C.)

With a range of movements much beyond the ordinary, and of more than the ordinary substantial construction, this camera is nevertheless no larger when folded than the ordinary film camera of quarter-plate size. The camera pulls out on its baseboard to



the position of focus for distant objects without any adjustment beyond the pulling of the front to the point where it catches. In this position it is held rigidly, and can only be racked further forward by turning back the spring catch and actuating the rack and pinion after unlocking the latter. For the position of double extension it is racked forward to the great distance from lens to plate of 12 ins. The front is of the specially solid construction adopted in the Wunsche series of instruments, and has rise of front attached by circular rack and pinion, whilst a similarly easily adjustable movement gives a cross front motion, or a rise when the camera is held landscape way of the plate. The instrument is provided with reversible finder and level, and is sent out with rapid symmetrical

lens working at $f/8$ and fitted in either one or other of several standard shutters. The attention given to minor, but not trifling, details is characteristic of the care which has evidently been expended on the design of the instrument. For example, there is a separate focussing scale for the single component of the lens; it is placed by the side of the one used at the normal extension, but one is covered when the other is being used. Similarly, the back of the camera is provided with spring chambers for the holding of the roll film spool, the removal of which is thus the work of a moment, whilst each chamber has a winding key which allows of a spool being wound in the reverse direction if necessary. The whole construction of the camera is that of an instrument intended for hard wear, and the price is £4 14s. with the symmetrical lens and "Univers" shutter, or £5 with the Bausch and Lomb "Automat." Other standard makes of lenses, such as the Goerz and Zeiss, can be fitted.

PRIMO-PLANE COOKE LENSES.

(Made by Taylor, Taylor, and Hobson, Leicester, England.)

Messrs. Taylor, Taylor, and Hobson have submitted to us two of the new Primo plane lenses designed according to Mr. H. D. Taylor's patent specification No. 7,661, 1906 ("B.J.A.," 1908, p. 539). Reference to this shows that the meaning of the term "primo-plane" is flatness of the primary image field; in other words, the lens is intended to render tangential lines sharply over a very wide flat field. The construction permits the use of a stop either in the interior of the objective or in front of and just grazing the front lens, and a specimen of each kind of mounting has been submitted to us. The lens at present is made only in the focal length of 5in., and it is intended for use as a wide angle lens on a half-plate. The aperture is marked $f/5$ in both patterns, but our measurements show that the lens with interior stop is somewhat faster than this, while the other with front stop is a trifle slower. In fact, we make the one $f/6.35$ and the other $f/7$. By reversing the lenses these apertures are respectively reduced to $f/6.2$ and $f/6.7$, so that a variable rapidity may be looked for if the lens is used for enlarging purposes. The central definition of these lenses is as fine as can be wished for, and they should prove most useful instruments to all who want wide-angled objectives of large aperture. The price of the 5in. lenses is £4 12s., and the larger sizes can be made to order.

THE MINIATURE "SELFIX" CAMERA.

(Sold by W. Butcher and Sons, Ltd., Camera House, Farringdon Avenue, London, E.C.)

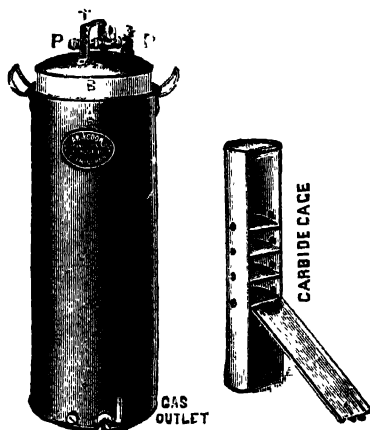
A tiny member of this series of self erecting cameras is made by Messrs. Butcher to take plates $2.5 \times 1.6 \times 1\frac{1}{2}$ in. (4.5×6 cm.). The little camera measures only $2\frac{1}{2} \times 3\frac{1}{2} \times 1\frac{1}{2}$ in., and on opening the baseboard comes out to the position of focus. The shortness of

focus of the lens allows of all objects no nearer than 6ft. to be in focus. Complete, with double finder for horizontal and vertical pictures, time, bulb, and instantaneous shutter, single achromatic lens, and two single metal slides, the price of the camera is two guineas. It can be supplied with Goerz "Dagor" $f/6.8$ complete for £7.

THE "MOSS-ABINGDON" ACETYLENE GENERATOR.

(Made by R. J. Moss and Sons, 98-99, Snow Hill, Birmingham.)

This new generator is made for use with ordinary lump carbide. The apparatus is a combination of the "Moss" and the well known "Abingdon," and the makers claim that it combines the best features of both. It certainly works with wonderful steadiness; there is no up and down movement, with consequent variation of pressure and fluctuating light, but a steady, gradually downward movement only as the carbide is used up. This also shows how far the carbide is used, and is one feature which should recom-



mend it to lanternists. An entire absence of mechanism or rubber washers is a most welcome point, and should be specially valuable to users in remote districts. The generator is made in three sizes, 1 lb., $1\frac{1}{2}$ lb., and $2\frac{1}{2}$ lb., and is listed at prices as follows:—1 lb. charge, 22s. 6d.; $1\frac{1}{2}$ lb., 26s.; $2\frac{1}{2}$ lbs., 32s. 6d. Messrs. Moss have also introduced a square tank pattern of all their generators. They have a good appearance, and as the gas outlet tap is placed in one of the corners it is less liable to be damaged in transit, besides which the gas is taken by a straight pipe from the top of the condenser chamber, therefore a stoppage by water (condensed) in the pipes is almost impossible.

THE "CHALLENGE" DAINTY POCKET CAMERA.

(Made by J. Lizars, 101 and 107, Buchanan Street, Glasgow.)

A most compact little camera is made by Mr. Lizars under this name for the popular $3\frac{1}{2} \times 2\frac{1}{2}$ plate. When folded it measures only $5 \times 4 \times 1\frac{1}{2}$ ins. It is fitted with rising front, focussing scale,



reversible brilliant finder, R R lens, and Bausch and Lomb ever-set shutter for time, bulb, and instantaneous exposures. The price of the camera complete with one slide is 28s. 6d. The drawing shows its size in relation to a volume of the "B.J. Almanac."

THE "CAMEO" ROLL-FILM HOLDER.

(Sold by W. Butcher and Sons, Limited, Camera House, Farringdon Avenue, London, E C.)

This is an attachment for an ordinary plate camera, such as the Butcher "Cameo" or "Ralli" series, to permit the use of roll-film. The holder is made to take the regular $3\frac{1}{4}$ -inch spools, and is fitted with winders and sight hole, after the manner of a roll-film camera. It is provided with a metal safety shutter, in order to allow of the attachment being removed before all the films have been exposed. The price is 25s.

[The separate items in the foregoing "Novelties in Apparatus" section are Indexed in the General Index to the Text portion of the "Almanac," placed at the end of the volume.]

FORMULÆ FOR THE PRINCIPAL PHOTOGRAPHIC PROCESSES.

ORTHOCHROMATIC PROCESSES.

(Most of the formulæ in this section are those used in the three-colour and process department of the L.C.C. School of Photo-Engraving, Bolt Court, London, E.C., to the Principal of which, Mr. A. J. Newton, we are indebted for a sistance in arranging them in the present form.— Ed. B. J. A.)

Sensitisers for Gelatine Plates.

1. For blue-green and green.

To sensitise up to wave-lengths, 5,500 A.U., the best dye is *acridin orange*, N.O. of the Leonhardt Farbwerke, Mülheim, Germany. It is used as directed below for green and yellow sensitising, except that ammonia must not be used.

2.—For green and yellow, but not red

To sensitise up to 5,900 A.U., *erythrosine* is still the best dye, though it leaves the plates somewhat insensitive to bluish green. The most suitable dye is that of Dr. Schuchardt, Goerlitz, or of Meister Lucius and Bruning, Hoeschst, a/M.

One part of dye is dissolved in 1000 parts of alcohol, and a bathing solution made as follows:—

Stock solution 1 : 1000	..	..	..	..	100 parts
Water	..	..	..	..	400 parts
Ammonia (0.880)	..	..	..	..	5 parts

This is a 1 : 5000 solution.

N.B.—Ammonia must not be used with *acridin orange*.

3.—Green, yellow and red.

To sensitise for all rays up to 6200 to 6400 A.U. the following are used:—

Orthochrome T, *Pinaverdol*, *Pinachrome*, or *Homocol*,
their order as red sensitisers being as above.

A stock solution is made containing 1 part of the dye in 1000 parts alcohol. The bathing solution contains:—

Stock solution	..	..	..	..	2 parts
Water	..	..	..	..	1000 parts

This is a 1 : 50,000 solution.

The stock solution will keep, but the weaker bath will not. A red light is used, until it is seen that the solution has covered the plates after which the operation must be continued in total darkness.

4. —*Extreme visible red*

To sensitise for the extreme visible red, *pinacyanol* should be used. The operations can be done in a weak green light, passing the part of the spectrum between 5,000 and 5,300. The dye solutions are prepared exactly as those of Orthochrome T, etc. See above.

5. —*Infra red.*

The best sensitiser for the infra red is *decyanine*, which is prepared and used exactly as *pinacyanol*, except that the stock solution must not be added to the water until the very last moment, when everything is quite ready, and the plate can be immediately flowed with the solution, as the weak solution loses its sensitising power very quickly.

If ammonia is used with the cyanine sensitisers given in 3, 4, and 5, it must be quite pure, or fog will be produced. It is best to dispense with it, but if used the proportion is about 1 part per 100 of sensitising bath.

PRACTICAL NOTES ON BATHING.

The dye solution is prepared in a measure, the plates are dusted and laid in a flat porcelain dish which is large enough to hold nearly twice the number of plates it is desired to sensitise at one time. These are put at one end of the dish; the dish is then tilted, and the dye solution poured into the other (empty) end, then the dish is tilted back, so that the dye solution sweeps over the plates in one even flow free from air belis. The dish is now gently rocked for three minutes, then the plates are removed and washed in a good stream of running water for at least another three minutes. Their sensitiveness will probably be somewhat greater if they are washed for ten minutes. They will remain good for months, kept under proper conditions, after three minutes' thorough washing, if bathed according to the formulæ given above.

ILFORD

ORDINARY (Yellow Label).
EMPRESS (Salmon Label).
SPECIAL RAPID (Red Label)

Easiest and Most Reliable Plates in the World.

No troubles, worries, or failures.

Full Price Lists post free on application.

ILFORD, Limited, ILFORD, LONDON, E.

The water tap should be fitted with one of the small anti-splash filters, the fine wire gauze in which retains any solid particles that may be in the water.

After washing, the plate should be well swabbed with a wad of cotton wool, and then placed in a drying cupboard. The quicker drying takes place the better, so that if a current of warmed, filtered air, free from fumes, can be sent through the cupboard it is an advantage, though the absence of this convenience need not deter anyone from sensitising plates. Drying can be hastened by placing a dish of dry calcium chloride or quicklime at the top of the cupboard.

Sensitisers for Collodion Emulsion.

FOR GREEN AND GREENISH YELLOW (Hübl).

Pinaverdol (1:500)	.. ..	1 oz.	40 c.c.s.
Collodion emulsion	.. ..	25 ozs.	1000 c.c.s.

The sensitiveness extends from the orange to the violet.

PANCHROMATIC SENSITISERS (Hübl).

Pinaverdol (1:500)	.. ..	3 ozs.	30 c.c.s.
Ethyl violet (1:500)	.. ..	$\frac{1}{2}$ oz.	5 c.c.s.
Collodion emulsion	.. ..	100 ozs.	1000 c.c.s.

FOR RED SENSITISING.

Pinacyanol (1:1000)	.. ..	3 ozs.	3 c.c.s.
Collodion emulsion	.. ..	100 ozs.	100 c.c.

FOR BLUE AND (SLIGHTLY) BLUE-GREEN SENSITIVENESS.

The following sensitiser increases the sensitiveness of the collodion for ordinary work:—

Canary II. (sat. sol.) (Reade Holliday, Huddersfield)	.. ..	1 oz.	10 c.c.s.
Emulsion .. ..	.. ..	10 ozs.	100 c.c.s.

The dyed emulsion keeps well, and in half-tone work gives a sharp clean dot.

ILFORD Chromatic and Rapid Chromatic Plates

POPULAR PRICES. The FINEST Isochromatic or Orthochromatic Plates made
All Ilford Plates are supplied BACKED (Anti-Halation)
to Order.

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ILFORD, Limited, ILFORD, LONDON, E.

Safe-lights for Developing.

(Newton & Bull.)

Yellow safe light for wet plates, bromide papers.

	Per sq. cm.	Grs. per sq. in. (approx.)
Tartrazine	1 mgm.	$\frac{1}{10}$
Or brilliant yellow	0.5 mgm.	$\frac{1}{20}$
Or naphthol yellow	1 mgm.	$\frac{1}{10}$
Or auramine	2 mgm.	$\frac{1}{5}$

Red safe light for ordinary plates.

	Per sq. cm.	Grs. per sq. in. (approx.)
Tartrazine	1 mgm.	$\frac{1}{10}$
Rose bengal (or fast red) ..	0.5 mgm.	$\frac{1}{20}$

Safe light for Ortho plates.

The above screen is combined with one containing -

Methyl violet	0.5 mgm.	$\frac{1}{20}$
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The red screen transmits light from the end of the visible red about λ 7,000 to λ 5,900 in the yellow. The methyl violet absorbs from λ 6,500 to λ 5,000, so that the only light passing the two is the extreme red of λ 7,000 to λ 6,500, to which even the best panchromatic plates are feebly sensitive.

The dyes are dissolved in gelatine solution, which in winter should be about 8 per cent. in strength and about 10 per cent. in summer. About 20 c.c.s. should be allowed for every 100 sq. cm. of glass, *i.e.*, about 20 minims per sq. in. The dyes are added, most conveniently from stock solutions, in quantity to give the proportions stated above in the filters.

DEVELOPERS AND DEVELOPMENT.

(Arranged alphabetically)

The following are a few of the typical formulæ generally employed for development, etc. A much greater variety will be found in the section headed 'Developing Formulæ of the Principal Plate-makers'

ILFORD Zenith Plates

(Chocolate and White Label.)

POPULAR
PRICES.

FASTEST AND BEST PORTRAIT PLATES.

Soft Negatives. Exceptional Latitude. No Fog.

Full Price Lists post free on application.

ILFORD, Limited, ILFORD, LONDON, E.

(pp. 827, &c). In these as in other formulæ in the ALMANAC "sodium sulphite" without qualification refers to the "cryst" and "recryst" sulphite, and "sodium carbonate" to the crystallised carbonate.

It should be noted also that the metric weights are not equivalents of the British item for item, but that the two formulæ give a solution of the same composition.

Adurol.

TWO-SOLUTION.

A. Adurol	85 grs.	19.5 gms.
Sodium sulphite	1½ oz.	175 gms.
Water	10 ozs.	1000 c.c.s.
B. Potass carbonate	1½ oz.	125 gms.
Water	10 ozs.	1000 c.c.s.

Adurol possesses a character intermediate between pyro and the long-factor developers, metol, amidol, etc

For studio work and snap-shots take 1 part of A, 1 part of B.

For time exposures outdoor take 1 part of A, 1 part of B, 1 part of water.

ONE-SOLUTION (CONCENTRATED).

Sodium sulphite	4 ozs.	400 gms.
Potass carbonate	3 ozs.	300 gms.
Water	10 ozs.	1000 c.c.s.

When all are dissolved add :—

Adurol	½ oz.	50 gms.
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For studio work and snap-shots take 1 part with 3 parts of water.

For time exposures outdoor take 1 part with 5 parts of water.

Amidol.

A normal developer consists of :—

Amidol	2—3 grs.	4.5—7.0 gms.
Sodium sulphite	25 grs.	57.5 gms.
Water to	1 oz	1000 c.c.s.

ILFORD PROCESS and HALF TONE PLATES

POPULAR
PRICES.

THE BEST PLATES FOR ALL
PHOTO-MECHANICAL
WORK.

Full Price Lists post free on application.

ILFORD, Limited, ILFORD, LONDON, E.

The mixed developer will keep well in solution for about a week, or sometimes longer, if its concentration does not exceed that given above. It must be made up with freshly dissolved sulphite, as this salt does not keep well in solution for more than a few weeks. A sodium sulphite solution that has been made neutral to litmus by the addition of potassium metabisulphite will, however, keep well for a very long period, and by the addition of dry amidol a fresh developer can be rapidly prepared when required

Make the following stock neutralised sulphite solution :--

Sodium sulphite	4 ozs.	200 gms.
Potassium metabisulphite ..	1 oz.	50 gms.
Water to	20 ozs.	1000 c.c.s.
use take—		
Amidol	2-3 grs.	45-70 gms.
Stock sulph. sol.	100 min.	200 c.c.s.
Water to	1 oz.	1000 c.c.s.

Azol.

The following are the instructions for the use of this single solution developer :—

For Plates and Films :—

Normal exposures :	Azol	20 mins.	$\frac{1}{2}$ oz.
	Water	to 1 oz.	to 6 ozs.
Under-exposures	Azol	15 mins.	$\frac{1}{2}$ oz.
	Water	to 1 oz.	to 8 ozs.
Over-exposures ;	Azol	30 mins.	$\frac{1}{2}$ oz.
	Water	to 1 oz.	to 4 ozs.

For stand development :—Azol, 1 oz ; water, 100 ozs.

For tank development :—Azol, $\frac{3}{4}$ oz. ; water, 40 ozs. Time of development of films at 60° F, 20 to 30 minutes. This solution may be used several times in succession.

For lantern slides and transparencies.—Azol, 25 mins. ; potass. bromide 10%, 5 mins., water to 1 oz

For bromide papers ;—Azol, 15 mins. ; water to 1 oz. A few drops of 10% solution potass. bromide may be added if the whites are grey.

For gaslight papers :—Azol, 40 mins. ; water to 1 oz. Add a few drops of 10% solution of potass. bromide, sufficient to keep the whites clear.

ILFORD MONARCH PLATES

(Purple and Gold Label.)

THE FASTEST AND FINEST PLATES IN THE WORLD.

Full Price Lists post free on application.

ILFORD, Limited, ILFORD, LONDON, E.

Edinol.**ONE-SOLUTION.**

For soft portrait negatives.

Sodium sulphite	5 ozs.	250 gms.
Edinol	96 grs.	11 gms.
Sodium carbonate	2 ozs.	100 gms.
Water	20 ozs.	1000 c.c.s.

For contrasty negatives.

Acetone sulphite (Bayer) ..	288 grs.	33 gms.
Sodium sulphite	4 ozs.	200 gms.
Edinol	96 grs.	11 gms.
Potassium carbonate	2 ozs.	100 gms.
Potassium bromide	48 grs.	5.5 gms.
Water	20 ozs.	1000 c.c.s.

The ingredients should be dissolved strictly in the order given.

Edinol tends to contrast when a carbonate is used: to softness when a caustic alkali is employed. A developer of the latter class contains, in one ounce, edinol, $2\frac{1}{2}$ grs.; caustic soda, $1\frac{1}{2}$ gr.; and sodium sulphite, 10 grs

Eikonogen.

A. Sodium sulphite	2 ozs.	100 gms.
Eikonogen	$\frac{1}{2}$ oz.	25 gms.
Distilled water	20 ozs.	1000 c.c.s.
B. Potass. carbonate	$1\frac{1}{2}$ oz.	75 gms.
Distilled water	20 ozs.	1000 c.c.s.

For use, mix equal volumes of A. and B.

ONE-SOLUTION.

Sodium sulphite	2 ozs.	100 gms.
Sodium carbonate	1 oz.	50 gms.
Distilled water	20 ozs.	1000 c.c.s.
Eikonogen	$\frac{1}{2}$ oz.	25 gms.

Eikonogen is a good developer for full detail without excessive density in the high-lights

ILFORD**LANTERN
Plates**POPULAR
PRICES.**"Special"** for Black Tones.**"Alpha"** for a beautiful range of warm tones.**"Gaslight"** for all Tones. No Dark Room needed.The **"Alpha"** Lantern is the **ONLY** Plate of its kind.The **"Ilford"** Gaslight Lantern is the easiest plate to use.

Full Price List post free on application.

ILFORD, Limited, ILFORD, LONDON, E.

Eikonogen-Hydroquinone.

A. Hydroquinone	40 grs.	45 gms.
Eikonogen	120 grs.	14 gms.
Sodium sulphite	480 grs.	55 gms.
Citric acid	20 grs.	2.3 gms.
Water to	20 ozs.	1000 c.c.s.
B. Potass. bromide .. .	5 grs.	0.5 gms.
Sodium carbonate.. ..	60 grs.	7 gms.
Caustic potash	30 grs.	3.5 gms.
Water to	20 ozs.	1000 c.c.s.

For use, mix in equal parts

This developer is suitable for negatives, lantern plates, and bromide papers

Ferrous Oxalate.

A. Potass. oxalate (neutral), 5 ozs ; hot water, 20 ozs. Cool, and pour off clear liquid for use.

B. Warm water, 20 ozs.; sulphuric acid, 30 minims; sulphate of iron, 5 ozs.

Mix 1 oz. of B. with 3 to 4 ozs. of A (pouring B into A, not *vice versa*).

A more powerful developer is made by dissolving commercial dry ferrous oxalate in boiling saturated solution of potassium oxalate. As much as will dissolve is stirred in, and the whole left to cool, after which the clear solution is poured off for use.

FOR TRANSPARENCIES ON GELATINO-CHLORIDE PLATES.

A. Neutral oxalate of potash ..	2 ozs.	100 gms
Ammonium chloride	40 grs.	4.5 gms.
Distilled water	20 ozs.	1000 c.c.s.
B. Sulphate of iron	4 drachms	34 gms.
Citric acid	2 drachms	17 gms.
Alum	2 drachms	17 gms
Distilled water	16 ozs.	1000 c.c.s.

For black tones, mix the above in equal volume.

ILFORD X-RAY Plates

Extra Sensitive.

UNEQUALLED IN QUALITY AND UNIFORMITY FOR ALL RADIOGRAPHIC WORK.

"In our opinion the Ilford X-Ray Plates are the best and most rapid at present obtainable."—*The Lancet*.

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ILFORD, Limited, ILFORD, LONDON, E.

HURTER AND DREIFFIELD'S STANDARD FERROUS OXALATE DEVELOPER

(The Photographic Journal, 1898.)

A. Potassium oxalate	..	..	..	..	1 part
Water	..	..	..	..	4 parts
B. Ferrous sulphate	..	..	..	..	1 part
Citric acid	..	..	..	..	0.01 part
Water	..	..	..	..	3 parts
C. Potass. bromide	..	..	..	..	1 part
Water	..	..	..	..	100 parts

For use take A, 100 parts; B, 25 parts; C, 10 parts. Development to be conducted at a temperature of 65° F.

The ferrous oxalate as compounded above contains in every 1000 parts:--Potassium oxalate, 185 parts, ferrous sulphate, 68.5 parts; citric acid, 0.61 parts; potassium bromide, 0.74 parts.

Glycin.

ONE-SOLUTION (HUBL).

Boiling water	..	..	4 ozs.	1000 c.c. s.
Sodium sulphite	..	..	2½ ozs.	625 gms.
When dissolved add				
Glycin	..	..	1 oz.	250 gms.
And then in small quantities				
Potass. carbonate	..	..	5 ozs.	1250 gms.

This forms a thick cream, which must be well shaken and then diluted with water; for normal work, dilute 1 oz. with 12 or 15 ozs of water, for very soft results with 30 ozs. of water.

ONE-SOLUTION.

Glycin	..	..	1 oz.	33 gms.
Sodium sulphite	..	..	2½ ozs.	83 gms.
Potass. carbonate	..	..	5 ozs.	166 gms.
Water to	..	..	30 ozs.	1000 c.c.s.

For normal exposures dilute with an equal bulk of water.

Glycin is a slow-acting developer, but perfectly free from stain. It is the best re-agent for "Stand Development" (which see).

ILFORD**KALONA****Self-Toning Paper**

GLOSSY, CARBON SURFACE, AND MATT.

POPULAR
PRICES.

Uniformity of Tone Automatically.
Kalona Post Cards, Glossy and Matt.
 Simplest, Best, Most Permanent.

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Hydroquinone.**ONE-SOLUTION.**

Hydroquinone	100 grs.	11.5 gms.
Sodium sulphite	1½ ozs.	75 gms.
Sodium carbonate	3 ozs.	150 gms.
Water to	20 ozs	1000 c.c.s.

May be diluted with an equal volume of water.

This formula is not so quick in action as the next one, but there is less tendency for the great density in the high-lights which is easily produced in cases of under-exposure. In all cases the temperature of the hydroquinone developer should not be allowed to fall below 60°, or the solution becomes inert.

TWO SOLUTION (CAUSTIC SODA).

A. Hydroquinone	160 grs.	18 gms.
Sodium sulphite	2 ozs.	100 gms.
Citric acid	60 grs	7 gms.
Potass bromide	40 grs.	4.5 gms.
Water to	20 ozs	1000 c.c.s.
B. Caustic soda (stick)	160 grs.	18 gms.
Water to	20 ozs.	1000 c.c.s.

For use:—A, 1 oz.; B, 1 oz.; water, 2 ozs.

ONE-SOLUTION (WITH FORMALINE).

Hydroquinone	150 grs.	15 gms.
Sodium sulphite	6 ozs.	300 gms.
Formaline	3 drachms	20 c.c.s
Water to	20 ozs	1000 c.c.s.

A slow developer, giving great clearness in the shadows, and plenty of density in high-lights, and specially suitable for line-subjects.

Kachin.

A. Kachin	160 grs	9 gms.
	(Avoirdupois)	
Sodium sulphite	2½ ozs.	62.5 gms.
Water to	20 ozs. (fl.)	500 c.c.s.
B. Sodium carbonate	2 ozs.	50 gms.
Water to	20 ozs. (fl.)	500 c.c.s

ILFORD P.

Reg Trade Mark

GLOSSY, CARBON SURFACE, and MATT

The LEADING Gelatino-Chloride Printing-Out Paper.

POPULAR
PRICES.

Distinguished from all others by its Exquisite Quality and
Climate-Resisting Properties. Used all over the World.

ILFORD P.O.P. Post-Cards. Glossy and Matt.

Full Price Lists post free on application.

ILFORD, Limited, ILFORD, LONDON, E.

For use take equal parts of A and B. More diluted developer gives softer results. The solutions should be used at a temperature of 60 to 65 degrees F. Assuming exposure to have been correct, with this solution the image commences to appear in about one minute, and when full density is required development is completed in from four to six minutes. Softer effects are obtained in from three to four minutes. No restrainer is really necessary, but in the case of over-exposure the use of a few drops of 5 per cent. solution of ordinary borax is recommended.

Kachin is almost free from staining properties, and is excellent in its clean development of stale plates, on which it does not produce the common iridescent markings.

Imogen Sulphite.

A. Imogen sulphite	1 oz.	83 gms.
Distilled water (warm)	12 ozs.	1000 c.c.s.
B. Sodium carbonate	1 oz.	500 gms.
Water	2 ozs.	1000 c.c.s.

For correct exposure, A, 2 ozs., B, 2 ozs.; water, 4 ozs. For under-exposure or soft negatives, A, 1 oz.; B, 3 ozs.; water, 4 ozs. For over-exposure, A, 2 ozs.; B, 2 ozs.; water, 3 ozs.; potassium bromide 40 per cent. solution, 1 oz.

Metol.

ONE-SOLUTION (HAUFF).

Metol	150 grs.	16 gms.*
Sodium sulphite	2½ ozs.	125 gms.
Sodium carbonate	3½ ozs.	175 gms.
Potassium bromide	16 grs.	2 gms.
Water	20 ozs.	1000 c.c.s.

For portraits, take stock solution, 1 oz.; water, 1 oz. For landscapes, stock solution, 1 oz.; water, 2 ozs.

Metol gives delicate negative with great detail and little density unless development is greatly prolonged. See "Time Development."

ILFORD Platona

Genuine Platinum Paper.

POPULAR
PRICES.

Smooth and Rough.

Full Price Lists post free on application.

ILFORD, Limited, ILFORD, LONDON, E.

TWO-SOLUTION (HAUFF).

A. Metol	.. ..	150 grs.	16 gms.
Sodium sulphite	.. ..	2½ ozs.	125 gms.
Water to	.. ..	20 ozs.	1000 c.c.s.
B. Sodium carbonate	.. ..	3½ ozs.	175 gms.
Potass bromide	.. ..	16 grs.	2 gms.
Water	.. ..	20 ozs.	1000 c.c.s.

For portraits, A, 1 oz. ; B, 1 oz. For landscapes, A, 1 oz. ; B, 1 oz. water, 1 oz.

ONE-SOLUTION (ANDRESEN).

Metol	.. ..	160 grs.	18 gms.
Sodium sulphite	.. ..	3½ ozs.	175 gms.
Potass carbonate	.. ..	1½ ozs.	87.5 gms
Potass bromide	.. ..	22 grs.	2.5 gms
Water	.. ..	20 ozs.	1000 c.c.s.

For use, take 1 part of developer to 3 of water

TWO-SOLUTION (ANDRESEN).

A. Metol	.. ..	160 grs	18 gms.
Sodium sulphite	.. ..	3½ ozs.	175 gms.
Water	.. ..	20 ozs.	1000 c.c.s
B. Sodium carbonate	.. ..	3½ ozs.	175 gms.
Water	.. ..	60 ozs	3000 c.c.s.

One part of A is mixed with 3 parts of B, potass bromide being added as required for prevention of fogging.

Metol-Hydroquinone.

ONE-SOLUTION.

Metol	.. ..	35 grs.	4 gms.
Sodium sulphite	.. ..	2 ozs.	100 gms.
Hydroquinone	.. ..	50 grs.	5.7 gms.
Sodium carbonate..	.. ..	1½ oz	75 gms.
Distilled water to	20 ozs.	1000 c.c.s.

This is mixed with an equal volume of water at the time of use.

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TWO-SOLUTION

A. Metol	40 grs.	4.5 gms.
Hydroquinone	50 grs.	5.7 gms.
Sodium sulphite	120 grs.	14 gms.
Potass bromide	.. .. .	15 grs.	2 gms.
Water to	.. .. .	20 ozs.	1000 c.c.s
B. Sodium carbonate	.. .. .	$\frac{1}{2}$ oz.	25 gms.
Water	.. .. .	20 ozs.	1000 c.c.s

Mix in equal parts.

In cold weather it is best to increase the proportion of metol to hydroquinone to say, 60 grs metol, 30 hydroquinone.

Ortol.

1. ORTOL-SODA

A. Ortol	.. .. .	140 grs.	15 gms.
Potass metabisulphite	.. .. .	70 grs.	8 gms.
Water, cold	.. .. .	20 ozs.	1000 c.c.s
B. Sodium carbonate	.. .. .	2 $\frac{1}{2}$ ozs.	125 gms.
Sodium sulphite	.. .. .	3 $\frac{1}{2}$ oz.	175 gms.
Potass bromide	.. .. .	10-20 grs.	1.1-2.3 gms.
Water	.. .. .	20 ozs.	1000 c.c.s

100 minims of 1 in 2 hypo solution may be added to solution A, and is said to brighten the shadows, but this addition is of doubtful value.

In cold weather the potassium bromide may be left out.

For quick development take 1 part of A and 1 part of B. For slow and soft development take 1 part of A, 1 part of B, and 1 part water.

Ortol solution should not be made up with sodium sulphite, otherwise red stain may be caused, nor should ammonia be used with it. In other respects it closely resembles pyro.

Paramidophenol.

ONE-SOLUTION.

Potassium metabisulphite	.. .. .	6 ozs.	300 gms.
Distilled water	.. .. .	20 ozs.	1000 c.c.s.
Paramidophenol	.. .. .	2 ozs.	100 gms.

Dissolve in the above order and add gradually—

Caustic soda or potash q.s.
to dissolve the precipitate first formed.

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For use, dilute 1 oz. with from 10-30 ounces of water.

Paramidophenol is non-stainless and keeps well in single solution owing probably to its preservative action on soda sulphite.

TWO-SOLUTION.

A. Paramidophenol hydrochloride ..	200 grs.	23 gms.
Potassium metabisulphite ..	100 grs.	11.5 gms.
Distilled water to.. ..	20 ozs.	1000 c.c.s.
B. Sodium sulphite	1 1/2 oz.	62.5 gms.
Potassium carbonate	1 1/2 oz.	62.5 gms.
Distilled water to.. ..	20 ozs.	1000 c.c.s.

For use, mix 1 oz. of A with 2 ozs. of B.

Pyro-Acetone.

A. Pyro.. ..	1 oz.	100 gms.
Sodium sulphite	4 ozs.	400 gms.
Distilled water to.. ..	9 ozs.	1000 c.c.s.

Potassium metabisulphite must not be used, unless neutralised, and there should be no addition of citric acid.

A normal developer consists of: -

A. sol (- pyro, 4 grs. or 8 gms)	40 minims	80 c.c.s.
Acetone	40 minims	80 c.c.s.
Water	1 oz.	1000 c.c.s.

and is made by measuring out 40 minims of A solution, adding 40 minims of acetone and making up to 1 oz.

Pyro-Ammonia.

(10% SOLUTIONS.)

A. Pyro solution as for pyro-potash or pyro-soda.		
B. Potass. bromide	1 oz.	100 gms.
Distilled water to	9 ozs	1000 c.c.s.
C. Liquid ammonia (0.880).. ..	1 oz. (fl.)	100 c.c.s.
Distilled water to.. ..	9 ozs.	1000 c.c.s.

To make a normal developer, take A, 20 minims; B, 10 minims; C, 30 minims; water to 1 oz.; or if no bromide is used, A, 20 minims; C, 10 minims; to water, 1 oz.; or in metric measures, A, 2 c.c.s.; B, 1 c.c.; C, 3 c.c.; water to 1 oz

Pyro-Potash.

(10% SOLUTIONS.)

A. Pyro	1 oz.	100 gms.
Potassium metabisulphite ..	1 oz.	100 gms.
Distilled water to	9 ozs.	1000 c.c.s.
B. Potassium carbonate	1 oz.	100 gms.
Sodium sulphite	1 oz.	100 gms.
Distilled water to	9 ozs.	1000 c.c.s.

A normal pyro-potash developer consists of:—

Pyro	2—4 grs.	4·6—9·2 gms.
Potassium carbonate	14 grs.	32·2 gms.
Water to	1 oz.	1000 c.c.s.

and is made by taking A, 20 to 40 minims; B, $\frac{1}{2}$ oz.; water to 1 oz., with 5 minims 10% potass. bromide solution if necessary; or, in metric measures, A, 4 to 8 c.c.s.; B, 50 c.c.s.; water to 100 c.c.s. (bromide 1 c.c.).

Pyro-Soda.

(10% SOLUTIONS.)

A. Pyro	1 oz.	100 gms.
Sodium sulphite	4 ozs.	400 gms.
Distilled water to	9 ozs.	1000 c.c.s.
B. Sodium carbonate (cryst.) ..	1 oz.	100 gms.
Distilled water to	9 ozs.	1000 c.c.s.

In the above formula the sulphite should be first dissolved in part of the water, and enough citric acid added to redden litmus paper, and then the pyro added and the total bulk made up by the addition of water. The sulphite may be replaced by 1 oz. (100 gms.) of potassium metabisulphite.

A normal pyro-soda developer consists of —

Pyro	2—4 grs.	4·5—9 gms.
Sodium carbonate	20 grs.	45 gms.
Water to	1 oz.	1000 c.c.s.

and is made by taking A, 20 to 40 minims; B, $\frac{1}{2}$ oz.; water to 1 oz. With 5 minims 10% potass. bromide solution if necessary.

The Hurter and Driffield standard pyro-soda developer for plate-speed testing is:—

Pyro	8 parts.
Sodium carbonate	40 parts.
Sodium sulphite	40 parts.
Water to	1000 parts.

Pyro-caustic Soda.

(VALENTA.)

A. Pyro	220 grs.	25 gms.
Soda sulphite	3 $\frac{1}{2}$ ozs.	162·5 gms.
Water to	20 ozs.	1000 c.c.s.
B. Caustic potash	100 grs.	1·5 gms
or		
Caustic soda	70 grs.	8·5 gms.
Water to	20 ozs.	1000 c.c.s.

Take A, 1 oz.; B, 1 oz.; water, 1 oz.

The above is a quick-acting and cheap developer, resembling metol in its characteristics.

Pyro-Metol.

Pyro	80 grs.	9.2 gms.
Metol	70 grs.	8 gms.
Potass. metabisulphite	180 grs.	20.0 gms.
Potass. bromide	30 grs.	3.5 gms.
Water to	20 ozs.	1000 c.c.s.
B. Soda carbonate	3 ozs.	150 gms.
Water to	20 ozs.	1000 c.c.s.

For normal exposures, use equal parts. For under-exposures increase the proportion of B and add water.

Pyrocatechin.**TWO-SOLUTION.**

A. Pyrocatechin	175 grs.	20 gms.
Sodium sulphite	1½ oz.	75 gms.
Water	20 ozs.	1000 c.c.s.
B. Potass. carbonate	2½ ozs.	125 gms.
Water	20 ozs.	1000 c.c.s.

Equal parts are mixed together.

ONE-SOLUTION.

Sodium sulphite	5 ozs.	250 gms.
Water	20 ozs.	1000 c.c.s.
Caustic soda	260-300 grs.	30.0-34.5 gms.
Pyrocatechin	400 grs.	46 gms.

The chemicals are dissolved in this order, and the stock solution kept well corked. It is diluted with 20 times its volume of water for use.

Rodinal.

Rodinal is a concentrated liquid preparation of para-amido phenol, sold also in solid form. The following are instructions for the use of the liquid:—

For general work, development of negatives:—Rodinal, 1 oz.; water, 25 ozs. A stronger solution, *e.g.*, Rodinal, 1 oz.; water, 10 oz., can be used to give density in a shorter time.

For over-exposures it is convenient to keep the following stock solution:—

Rodinal	1 oz.	30 c.c.s.
Potass. bromide	150 grs.	10 gms.
Water	1 oz.	30 c.c.s.

And add a few drops to the 1:30 rodinal developer in cases of over-exposure.

For under-exposures:—Rodinal, 1 oz.: water, 30, 40, or 80 oz.

Stand Development.

Glycin is a very suitable developer for this purpose, and the following directions are given by Hubl for the use of the formula (given on another page) for a concentrated solution.

Normal developer: Stock sol., 1 oz.; water, 80 to 90 oz.; potass bromide, 10 per cent sol., 80 minims.

In this solution a properly exposed plate should make its appearance in 15 or 20 minutes, and obtain full density in several hours.

For under-exposures - Stock sol., 1 oz.; caustic soda sol. (10%) 1 oz.; water, 50 oz., warmed to 75 degrees F.

For over exposures - Stock sol., 1 oz.; potass bromide, 10% sol. 1 oz.; water, 25 ozs.

Factorial Development.

The total time of development (found by trial to give a certain amount of contrast) divided by the time in which the image first appears is the "factor" of a developer.

The following "Watkins' factors" are abstracted from the instructions from the "Watkins' dark room clock and factorial calculator":—

SUGGESTED FACTORS.

	Grs. pyro to oz.	Fac tor.		Grs. pyro to oz.	Grs. brom. to oz.	Fac tor.
Pyro-soda	1	18	Pyro-soda	1	$\frac{1}{2}$	9
without	2	12	with	2	$\frac{1}{4}$	5
bromide	3	10	bromide	3	$\frac{1}{4}$	4 $\frac{1}{2}$
	4	8		4	1	4
	5	6 $\frac{1}{2}$		8	2	3 $\frac{1}{2}$

Pyro-acetone -about double the above figures

	Factor.		Factor.
Adurol (Schering or Hauff)	5	Ilford pyro-soda (minimum pyro)	5 $\frac{1}{2}$
Amidol (2 grs. per oz.)	18	Imogen sulphite	6
Cristoid developer and film	30	Imperial pyro-soda	4 $\frac{1}{2}$
Diamidophenol	60	Imperial standard (pyro-metol)	9
Diogen	12	Kachin	10
Edinol	20	Kodak powders	18
Eikonogen	9	Metol	30
Glycin (carb. sol.)	8	Metol-hydroquinone	14
Glycin (carb. pot.)	12	Ortol	10
Hydroquinone (min. B)	5	Pyrocatechin	10
Hydroquinone (max. B)	4 $\frac{1}{2}$	Quinomet	30
Ilford pyro-soda (maximum pyro)	4 $\frac{1}{2}$	Rodinal	40

Note.—High-factor developers (*e.g.*, metol and rodinal), owing to the long time which is needed for density, tend to softness. Short-factor developers (*e.g.*, hydroquinone and strong pyro-soda) tend to hardness, as they quickly build up density after the image appears.

Where a factor divides evenly into 60, the product is called a divisor, and will greatly facilitate calculating the total time of development. Thus adurol has a divisor of 12 (60 divided by 5), and if the time of appearance in *seconds* is divided by 12 the result is the number of *minutes* to develop.

PYRO-SODA DEVELOPERS.

With and without bromide.

	Factor.		Factor.
Austin-Edwards (with B)	5	Marion (with B)	4½
Barnet (with B)	4½	Mawson (no B)	10
Cadett (no B)	9	Paget (no B)	11
Kodak (no B)	12	Thomas (with B)	5
Edwards (with B)	4½	Wratten (no B)	11
Premier (with B)	4½	Wellington (normal)	11
Gem (with B)	4	Wellington (studio)	15

Combined Development and Fixing.

Although there is not much to be said for simultaneous development and fixing on practical grounds, the following formula may be given as one of the best for the purpose.—

A. Kachin	150 grs.	17 gms.
Sodium sulphite	3 ozs.	150 gms.
Water to	20 ozs.	1000 c.c.s.
B. Caustic soda	160 grs.	18 gms.
Water to	20 ozs.	1000 c.c.s.
C. Hypo	1 oz.	560 gms.
• Water to	2 ozs.	1000 c.c.s.

Take:—A, 160 minims; B, 24 minims; C, 20 minims; water to 1 oz; or, A, 32 c.c.s.; B, 5 c.c.s.; C, 4 c.c.s.; water to 100 c.c.s.

Restrainers.

Potassium bromide in 10 per cent. solution is the most common restrainer. The dose is from one half-grain (5 minims) per ounce of developer.

Ammonium citrate solution has the advantage that after it has been added to the developer density can be obtained without further fogging, though the development of detail is prevented. An average dose with the pyro-ammonia developer is 6 to 10 grains per ounce (60 to 100 minims of solution made by adding ammonia, about 250 minims, to 1 ounce of citric acid dissolved in a little water until neutral, and diluting the whole to 10 ounces).

Potassium borotartrate.—10 to 30 minims of a 10 per cent. solution restrain with most developers.

Sodium bicarbonate acts as a restrainer, particularly with amidol developer.

FIXING, & HYPO ELIMINATORS

Acid Fixing Baths.

Hypo solution (1:5)	.. ..	50 ozs.	1000 c.c.s.
To which add a mixture of -			
Tartaric acid solution (1:2)	.. ..	1½ oz.	30 c.c.s.
Sodium sulphite solution (1:4)	.. ..	3½ ozs.	70 c.c.s.

Alum-Hypo Fixing Bath.

Alum (saturated solution)	.. ..	20 ozs.	1000 c.c.s.
Sodium sulphite (saturated solution)	.. ..	4 7 ozs.	200-300 c.c.s.
Hypo-solution (1:5)	.. ..	20-28 ozs.	1000 1250 c.c.s.

An excellent acid fixer is made by adding about ½ oz. of 'potass metabisulphite to each pint of fixing bath.

Chrome Alum and Hypo Fixing Bath.

Add --			
Strong sulphuric acid	.. ..	1 drach (fl)	10 c.c.s.
Water	.. ..	2 ozs.	80 c.c.s.
to--			
Sodium sulphite	.. ..	2 ozs.	80 gms.
Water	.. ..	6 ozs.	240 c.c.s.
And pour the mixture into			
Hypo	.. ..	16 ozs.	700 gms.
Water	.. ..	48 ozs.	2000 c.c.s.
Finally add to the above mixture--			
Chrome alum	.. ..	1 oz.	40 gms.
Water	.. ..	8 ozs.	300 c.c.s.

Hypo-eliminators.

Peroxide of hydrogen (20 vols.)	.. ..	1 drachm	25 c.c.s.
Water	.. ..	5 ozs.	1000 c.c.s.

After washing the negative well it is immersed for a couple of minutes in the solution and again rinsed in water.

Where peroxide of hydrogen is not obtainable, the following may be used as a substitute --

Barium dioxide	.. ..	1 oz.	25 gms.
Glacial acetic acid	.. ..	1 oz.	25 gms.
Water	.. ..	40 ozs.	1000 c.c.s.

Reduce the barium dioxide to a fine powder and add it gradually to the acid and water, shaking until dissolved. A few minutes' immersion in this solution will effectually remove or destroy the last traces of hypo.

PERSULPHATE.

Ammonium persulphate	2½ grs.	6 gms.
Carbonate of soda	5 grs.	12 gms.
Water	1 oz.	1000 c.c.s.

PERCARBONATE.

Potassium percarbonate	2½ grs.	6 gms.
Water	1 oz.	1000 c.c.s.

PERMANGANATE.

Wash the negative for one minute under the tap, and transfer to a shallow dish containing water with enough potass permanganate in it to turn it pink. Remove the negative as soon as the colour goes, and keep on treating in the very weak permanganate baths until the colour is not discharged. A very cheap and satisfactory process which allows of a negative being ready for drying within three minutes of fixation.

Rapid Drying of Negatives.

Method I.--Rinse from the hypo-bath, place in 1:50 formulae for ten minutes, wash by pouring nearly boiling water six times over the negative and dry by heat. To get rid of the relief which is produced by this process the negative is rubbed with a piece of washleather moistened with alcohol.

Method II.--After washing in the usual way or using a hypo-eliminator, lay a piece of old fine cambric on the negative and firmly pass a roller squeegee over it. The negative, with much of the water thus removed, will dry in a few minutes in a moderately warm place.

Method III.--Soak in two successive baths of methylated spirit, and place in a current of air. The present commercial spirit, owing to the mineral naphtha in it, causes a whitish scum on the surface of the film, and is not favourable to clean work.

HARDENING AND CLEARING SOLUTIONS.

Hardening Baths.

Formaline	1 oz.	50 c.c.s.
Water	10 to 20 ozs.	500-1000 c.c.s.
Alum	1 oz.	50 gms.
Water	20 ozs.	1000 c.c.s.
Chrome alum	1 oz.	50 gms.
Water	20 ozs.	1000 c.c.s.

Clearing Solutions.

ACID ALUM.

Alum	..	..	..	2 ozs.	200 grms.
Citric acid	..	..	..	1 oz.	100 grms.
Water	..	..	..	10 ozs.	1000 c.c.s.

Wash moderately after fixing, and immerse the negative in the above. This bath is also useful for removing white scum from negatives developed with ferrous oxalate if rubbed on with cotton wool.

CHROME ALUM.

Chrome alum	..	..	..	$\frac{1}{2}$ oz.	25 grms.
Hydrochloric acid	..	..	..	$\frac{1}{2}$ oz.	25 c.c.s.
or					
Citric acid	..	..	..	1 oz.	50 grms.
Water	..	..	..	20 ozs.	1000 c.c.s.

THIOCARBAMIDE.

Thiocarbamide	..	..	..	90 grs.	10 grms.
Citric acid	..	..	..	90 grs.	10 grms.
Water	..	..	..	20 ozs.	1000 c.c.s.

SODIUM HYPOCHLORITE.

(*Eau de Javelle*.)

Bleaching powder	..	..	..	1 oz.	30 grms.
Sodium carbonate	..	..	..	$1\frac{1}{2}$ oz.	45 grms.

Shake up the bleaching powder with a solution of the carbonate in a little water (6 ozs. or 180 c.c.s.), and filter. Extract the residue with plain water, and again filter. The filtrate (solution of sodium hypochlorite) forms an active stain remover. It can be acidified with oxalic acid, and then discharges yellow stain still more vigorously, but with risk to the silver image.

REMOVING SILVER STAINS.

Soak the negative in—

A. Potass. iodide	..	..	..	200 grs.	45 grms.
Water	..	..	..	10 ozs.	1000 c.c.s.

And after washing transfer to—

B. Potass. cyanide	..	..	..	300 grs.	70 grms.
Water	..	..	..	10 ozs.	1000 c.c.s.

in which rub the stained part of the film with a pledget of cotton wool.

If the stain does not yield to this treatment a solution of iodine (in potass iodide) may be used in place of solution A.

A remedy for silver stains, which sometimes succeeds, is to rub with pumice powder, and place in strong hypo.

NEGATIVE INTENSIFIERS.

Mercury Intensification.

The negative is bleached in the following saturated solution of mercury bichloride:—

Mercury bichloride (corrosive sublimate)	1 oz.	62 gms.
Hot water	16 ozs.	1000 c.c.s.

After cooling this solution and pouring off from the white feathery crystals thrown down, add—

Hydrochloric acid	30 minims	4 c.c.s.
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After well washing, the bleached negative is blackened in one or other of the following:—

A. Ammonia (0 880)	20 drops	20 drops
Water	1 oz	30 c.c.s.

Gives great intensification and good black colour.

B. Soda sulphite, 10 per cent. solution, made slightly acid with citric acid. Very slightly strengthens a negative.

C. An alkaline developer, such as pyro-soda, pyro-ammonia, hydroquinone, or ferrous oxalate. Gives about double the intensification of B.

D. Schlippe's salt	200-400 grs.	20-40 gms.
Water	20 ozs.	1000 c.c.s.

This solution must be made fresh, and gives great intensification.

Monckhoven's.

A. Bromide of potassium	10 grs.	23 gms.
Bichloride of mercury	10 grs.	23 gms.
Water	1 oz.	1000 c.c.s.
B. Pure cyanide of potassium ..	10 grs.	23 gms.
Nitrate of silver	10 grs.	23 gms.
Water	1 oz.	1000 c.c.s.

The silver and cyanide are dissolved in separate lots of water, and the former added to the latter until a permanent precipitate is produced. The mixture is allowed to stand 15 minutes, and, after filtering, forms Solution B.

Place the negative in A till it is white, then rinse and transfer it to solution B. If the intensification has been carried too far, it may be reduced by treatment with a weak solution of hyposulphite of soda.

Mercuric Iodide.

Water	20 ozs.	1000 c.c.s.
Sodium sulphite	4 ozs.	200 gms.
Mercuric iodide	90 grs	10 gms

The sulphite must be dissolved first. The solution keeps well in the dark. The plate needs to be rinsed only from the fixing bath, and

requires to be immersed for only a few minutes in water and then for a few seconds in hypo (10 grs. per oz.) after sufficient intensification has been obtained. Greater permanency is secured by treating instead with any non-staining developer, or, better, with 5 per cent. solution of sodium sulphide.

If mercuric iodide is not available the following may be used:—

Mercuric chloride..	..	..	50 grs.	6 gms.
Water	..	..	10 ozs.	500 c.c.s.

Add 10 per cent. potass. iodide solution until precipitate first formed is redissolved. About $1\frac{1}{2}$ oz. (75 c.c.s.) will be required, and, when clear, add—

Sodium sulphide ..	..	..	4 ozs.	200 gms.
Water to make ..	..	..	20 ozs.	1000 c.c.s.

Silver Intensifiers.

J. B. B. WELLINGTON'S FORMULA.

Silver nitrate ..	..	..	120 grs.	7.75 gms.
Water	..	..	2 ozs.	60 c.c.s.

Add—

Ammonium sulphocyanide ..	..	..	240 grs.	15.5 gms.
Water	..	..	3 ozs.	85 c.c.s.

This mixture is best made at the time of use, although it may be left for several weeks. To prepare the intensifier, take—

Above mixture ..	..	..	$\frac{1}{2}$ oz.	30 c.c.s.
Hypo solution (1 in 4) ..	..	..	enough to just dissolve white ppt	
Pyro (10% sol.) with sulphite ..	..	..	30 minims	4 c.c.s.
Ammonia (10% sol.) ..	..	..	40—60 „	6—8 c.c.s.

Plates should be hardened with alum or formalin, for both this and the following intensifier. When sufficient density is obtained the negative is fixed for a minute or two and washed.

ACID SILVER.

A. Pyro..	..	..	..	15 grs.	3.5 gms.
Citric acid ..	..	..	..	5—10 grs.	1—2 gms.
Water	..	..	..	10 ozs.	1000 c.c.s.
B. Silver nitrate ..	..	..	..	10 grs.	23 gms.
Water to ..	..	..	..	1 oz.	1000 c.c.s.

About 1 oz. (30 c.c.s.) of A is poured over the plate, once or twice, about 15 drops of B solution added, and the mixture again applied. Intensification now takes place and the solution is poured off and on until sufficient. If intensifier becomes very thick and turbid, fresh should be mixed up. When dense enough the negative is rinsed, fixed and washed.

Chromium Intensifier.

(C. Welborne Piper.)

	A.	B.	C.
Potassium bichromate ..	5 grs.	10 grs.	10 grs.
Hydrochloric acid (sp. gr., 1.160) ..	..	..	..
Water	1 min.	5 min.	20 min.
	1 oz.	1 oz.	1 oz.

Bleach in A, B or C solution, wash until yellow stain is removed, and then develop with amidol.

A gives intensification about equal to mercury and ammonia; B, to that of mercury and ferrous oxalate; and C, to that of mercury and sodium sulphite.

The process may be safely applied after fixation if the plate is simply rinsed for a minute or so.

It may be repeated several times if the first application does not give enough density.

Copper Intensifier.

A. Copper sulphate	100 grs.	230 gms.
Water	1 oz.	1000 c.c.s.
B. Potass. bromide	100 grs.	230 gms.
Water to	1 oz.	1000 c.c.s.

A and B are separately made up with hot water, mixed, and allowed to cool. The negative is bleached in the mixture, and washed for a minute or two. It is then blackened in:—

Silver nitrate	45 grs.	100 gms.
Water (distilled)	1 oz.	1000 c.c.s.

For still greater density, the negative is well washed from silver, and an ordinary developer applied.

If too dense, after the silver, it can be placed in weak hypo solution (about 10 grs. per oz.) or weak potass cyanide (about 2 grs. per oz.).

Lead Intensifier.

Lead nitrate	400 grs.	46 gms.
Potass. ferricyanide	600 grs.	70 gms.
Acetic acid	3 drachms	20 c.c.s.
Water to	20 ozs.	1000 c.c.s.

This stock solution will keep for a long time in the dark. The negative is bleached in it, washed once *very carefully* in 10 per cent. nitric acid—the acid makes the film very tender—then in water, and darkened in:—

A. Sodium sulphide	1 oz.	50 gms.
Water	20 ozs.	1000 c.c.s.

Or in—

B. Schlippe's salt	90 grs.	10 gms.
Ammonia (.880)	6 drachms	40 c.c.s.
Water	20 ozs.	1000 c.c.s.

Or in—

C. Potass. bichromate	1 oz.	100 gms.
Ammonia (.880)	$\frac{1}{2}$ oz.	50 c.c.s.
Water	10 ozs.	1000 c.c.s.

The lead intensifier gives very great intensification, and is suited only for line-subjects.

Uranium Intensifier.

A. Uranium nitrate	100 grs.	23 gms
Water	10 ozs.	1000 c.c.s.
B. Potass. cyanide	100 grs.	23 gms.
Water	10 ozs.	1000 c.c.s.

The intensifier is prepared from—A sol., 1 oz.; B sol., 1 oz.; acetic acid, 2 drachms.

The plate must be perfectly free from hypo, and after intensification be washed in several changes of *still* water until the yellow stain is gone. A 10 gr. per oz. solution of ammonium sulphocyanide removes any yellow stain, and weak ammonia or sodium carbonate removes the intensification altogether, restoring the negative to its original state. A weak acetic acid bath should then be applied to the negative if the intensifier is to be again applied.

NEGATIVE REDUCERS.

Farmer's.

Hypo solution (1:5)	5 ozs.	150 c.c.s.
Potass. ferricyanide (10% sol) ..	quant. suff.	quant. suff.

The colour is a fair indication of the strength of the reducer; it should be pale yellow, not orange, and should be used weak rather than strong, since its selective action on the shadows of a negative is then less. Yellow stain is due usually to the use of an acid fixing bath, or an old fixing bath, instead of clean plain hypo solution. It is not easy to remove

Belitski's.

Potass. ferric oxalate	150 grs.	10 gms.
Sodium sulphite	125 grs.	8 gms.
Water.. .. .	7 ozs.	200 c.c.s.

Dissolve and add—

Oxalic acid.. .. . 40 to 45 grs. 2.5 to 3.1 gms.
and shake until the solution turns green. Then pour off from undissolved crystals and add—

Hypo	1½ ozs.	50 gms.
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Instead of the ferric oxalate the following more easily obtainable chemicals can be used in the formula:—

Ferric chloride cryst.	100 grs.	6.5 gms.
Potass. oxalate	190 grs.	12.5 gms.

This reducer is stainless, and keeps well in the dark,

Persulphate.

Ammonium persulphate..	..	10 to 20 grs.	23 to 45 gms.
Water .. .. .	..	1 oz.	1000 c.c.s.

A fresh solution is made at time of use. A drop of sulphuric acid per 2 ozs. makes the action more regular. It is best also to use the reducer before the negative has dried. When sufficiently reduced—indeed, slightly before—the negative is placed at once into 5 per cent. sodium sulphite solution. If much reduction has taken place it is well to fix a second time.

Eder's (Mercury and Cyanide).

Potassium cyanide	20 grs.	5 gms.
Potassium iodide	10 grs.	2 gms.
Mercury bichloride	10 grs.	2 gms.
Water	10 ozs.	1000 c.c.s.

Reduction takes place slowly and is easy to control

Dissolve the mercury, then the iodide, and lastly the cyanide to dissolve the red precipitate formed. The solution reduces slowly, but is non-staining.

Iodine-cyanide.

Iodine (10 per cent. sol. in potass iodide sol.)	30 minims	6 c.c.s.
Potass cyanide (10 per cent. sol. in water)	5 minims	1 c.c.
Water	1 oz.	100 c.c.s.

Bichromate.

Potass bichromate	100 grs.	20 gms.
Sulphuric acid	7 drachms (fl.)	40 c.c.s.
Water	20 ozs.	1000 c.c.s.

Ceric Sulphate.

Sulphuric acid (sp gr. 1.98) ..	20 minims	4 c.c.s.
Water	2 ozs.	200 c.c.s.
Dissolve in this :—		
Ceric sulphate	2 ozs.	100 gms.
And dilute to:—		
Water	10 ozs.	1000 c.c.s.

Hard negatives are placed wet in a mixture of this stock solution and nine times its volume of water. Reduces contrasts. Over-exposed, long-developed negatives are dipped dry into a mixture of stock solution and an equal part of water and carefully watched as the action is very rapid. A convenient form of the reducer is the stock solution sold by Lumière.

Permanganate.

Potass permanganate, 10% solution	1 drachm	10 c.c.s.
Sulphuric acid (10% solution by volume of 1.98 acid)	5 drachms	50 c.c.s.
Water	10 ozs.	1000 c.c.s.

Applied to a wet negative gives even reduction. A dry negative receives greater reduction in the high-lights, and great softening may be obtained by immersing dry negative quickly in the reducer, washing immediately, drying and re-immersing. Any brown stains are removed with a 10% solution of sodium sulphite containing 2% oxalic acid.

Hypochlor and Alum.

Chrome alum	10 grs.	4 gms.
Plan de Javelle	$\frac{1}{2}$ oz.	100 c.c.s.
(See "Clearing Solutions")		
Water to make	5 ozs.	1000 c.c.s.

Immerse the negative and gently rub the surface with a piece of cotton wool. By confining friction with the wool to certain parts, extra reduction can be obtained.

Eder's Method of Reducing Hard Negatives.

Potass bichromate	90 grs	10 gms.
Hydrochloric acid	1 oz. (fl.)	30 c.c.s
Alum	1 oz.	50 gms
Water	20 ozs.	1000 c.c.s.

The negative is bleached through to the back in this solution, well washed and redeveloped in any non-staining developer, such as glycin or rodinal, only up to the right degree of contrast.

Baskett's (Local) Reducer.

It consists of--

(Globe metal polish	2d. tin
Terebene	2 ozs.
Salad oil	2 ..

The ingredients are to be well mixed, and strained through fine muslin two or three times to remove any coarse particles.

NEGATIVE VARNISHES.

Hot Varnishes.

No. 1. Sandarac	4 ozs.	113 gms.
Alcohol	28 ozs.	800 c.c.s.
Oil of lavender	3 ozs.	85 c.c.s.

This is a good varnish for retouching upon, and a tooth is easily obtained by rubbing.

No. 2. Seed lac	2 ozs.	50 gms.
Sandarac	2 ozs.	50 gms.
Oil of lavender	$\frac{1}{2}$ oz.	12.5 gms.
Castor oil	1 oz.	25 c.c.s.
Alcohol	40 ozs.	1000 c.c.s.

To prepare a good surface for the retouching pencil, the negative after varnishing is dusted over with fine resin powder and rubbed up with the fingers.

No. 3. White hard varnish	15 ozs.	150 c.c.s.
Rectified spirit (not methylated spirit)	20 to 30 ozs.	200 to 300 c.c.s.

This will be found a good and cheap varnish if durability is not required, as it is easily rubbed up for retouching upon and easily cleaned off. Very suitable for enlarged negatives that are not to be retained.

No. 4. Bleached shellac	1 $\frac{1}{2}$ ozs.	62 gms.
Mastic	$\frac{1}{2}$ oz.	13 gms.
Oil of turpentine	$\frac{1}{2}$ oz.	13 c.c.s.
Sandarac	1 $\frac{1}{2}$ oz.	62 gms.
Alcohol	20 ozs. (fl.)	1000 c.c.s.

Tough, hard, and durable.

No. 5. Sandarac	80 ozs.	160 gms.
Turpentine	36 ozs.	72 c.c.s.
Oil of lavender	10 ozs.	20 c.c.s.
Alcohol	500 ozs.	1000 c.c.s.

This one may also be rubbed down with powdered resin, and gives a splendid surface for retouching.

No. 6. Sandarac	1 oz.	55 gms.
Seed lac	1 $\frac{1}{2}$ oz.	83 gms.
Castor oil	3 drachms	20 c.c.s.
Oil of lavender	1 $\frac{1}{2}$ drachms	10 c.c.s.
Alcohol	18 oz (fl.)	1000 c.c.s.

This varnish is somewhat dark in colour.

No. 7. Best orange shellac	2 $\frac{1}{2}$ ozs.	125 gms.
Oil of lavender or oil of turpentine	$\frac{1}{2}$ oz.	13 c.c.s.
Methylated alcohol	20 ozs.	1000 c.c.s.

Keep in a warm place until dissolved; then add a large teaspoonful of whiting or prepared chalk; shake, set aside to clear, and then decant. This is specially recommended for gelatine negatives.

Cold Varnishes.

No. 1. Celluloid	1 oz.	10 gms.
Amyl acetate	50 ozs.	500 c.c.s.

This may be flowed over or applied with a brush to the negative, and requires no heat

No. 2. Zanzibar copal	6 ozs	30 gms.
Amber (fused)	1 oz.	5 gms.
Ether	60 ozs.	300 c.c.s.
Acetone	40 ozs.	200 c.c.s.
Chloroform	4 ozs.	20 c.c.s.

No. 3 20% shellac solution	2 ozs.	160 c.c.s.
Ammonia ('880)	3 drachms	30 c.c.s.
Methylated spirit	4 ozs	320 c.c.s.

A mixture of Japanese gold size (1 part) and benzole (2 parts) forms a rather slow-drying though otherwise excellent cold varnish. The surface takes the pencil well.

SHELLAC WATER VARNISH.

Shellac	3 ozs.	100 gms.
Sodium carbonate (saturated solution)	24 ozs	800 c.c.s.

The shellac is allowed to soak in the liquid for twenty-four hours; the liquor is then poured away and replaced by an equal quantity of water, and the mixture boiled until the shellac dissolves. After standing some time the liquid becomes perfectly clear and bright.

Film Varnishes.

The above water varnish is suitable, or the following:—

Borax	300 grs.	30 gms.
Glycerine	300 minims	30 c.c.s.
Shellac	600 grs.	60 gms.
Water	20 ozs.	1000 c.c.s.

Boil together for about half an hour, then add—

Methylated spirit	5 ozs.	250 c.c.s.
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and filter.

Another good varnish for celluloid films is —

Dammar	500 grs.	115 gms.
Benzole	10 ozs.	1000 c.c.s.

in which, after filtration, the films are immersed and then hung up to dry.

Celluloid in amyl acetate (No. 1 in "Cold Varnishes" above) can also be used and is an excellent varnish for films.

Retouching Medium.

Pale gum resin	200 grs.	230 gms.
Gum dammar	90 grs.	100 gms.
Gum mastic	20 grs.	23 gms.
Oil of juniper	1 gr.	1 gm
Oil of turpentine	2—4 ozs.	1000-2000 c.c.s.

The gums are powdered and added to the oils and finally enough pure asphaltum is added to give the mixture a dark amber colour when viewed through the depth of an inch.

This formula is strongly commended by Whiting in his "Retouching" as not liable to pick, rub off or come off on after-varnishing. It takes a great deal of work.

Ground-Glass Varnish.

Sandarac	90 grs.	103 gms.
Mastic	20 grs.	23 gms.
Ether ('720)	2 ozs.	1000 c.c.s.

Dissolve the resins in the ether and afterwards add--

Benzole	$\frac{1}{4}$ to $1\frac{1}{2}$ ozs.	120-700 c.c.s.
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The proportion of the benzole added determines the nature of the matt obtained.

This varnish must be applied to the cold negative or the coating will not be matt.

Malachite green, aurantia, or asphaltum is used for tinting it green, yellow, or brown respectively (for handwork on back of negative).

Spotting Medium.

Indian ink	water colour chalk.
Payne's grey	water colour chalk.

Grind together with water only on a palette to match the colour of the negative.

Blocking-out Mixtures.

No. 1. Gamboge and vermilion red, or Payne's grey and vermilion are ground together in water in equal parts with addition of a little gum water if a glossy surface is required.

No. 2. Asphaltum	1 oz.	100 gms.
Wax	170 grs.	40 gms.
Carbon black	80 grs.	20 gms.
Turpentine	10 ozs.	1000 c.c.s.

Commercial "Brunswick black" is equal to and more convenient than the above mixture.

Titles on Negatives.

The usual method is to have the words forming the title set up in type and photographed on a "process" plate. The subject negative having been made with a clear margin round it, a strip of the title negative is laid down on this margin by stripping and the clear margin then filled up with "photopake" or other blocking-out mixture except over the strip of title which is made dense enough, in the first instance, to print white. If a clear portion in a landscape negative cannot be found (in cases where the title has to appear on the view), a piece must be cut out with a sharp knife.

STRIPPING.

Gelatine Glass Negatives.

(Middleton and Holcroft.)

Stock solution :—

Methylated spirit	25 ozs.	250 c.c.s.
Water	1 oz	10 c.c.s.
Glycerine	1 oz.	10 c.c.s.

To prepare the "stripping solution" 6 to 30 drops of commercial hydrofluoric acid are added to 1 oz. (30 c.c.s.) of the above. The film is cut through all round about $\frac{1}{8}$ inch from the edge, and placed level by aid of three wedges. The "stripping solution" is spread with a strip of paper, and the loose edgings of film removed as soon as they come away without any pull whatever. The looseness of the main film is now tested by passing a waxed silk thread, stretched on a bow underneath it. If all is free, the solution is poured off, and plain "stock solution" poured on.

The loose film is now transferred to a glass plate, previously coated with a coating of gum, which should be so thin as to show only when the plate is moistened with the finger. As lifters of the films, "paraffin sheets" (made by soaking thin paper in hot melted paraffin for about half an hour) are used, being semi-transparent and free from buckle. One is laid on the film and lightly squeegeed down. The two are removed together in contact by slipping the blade of a penknife under the film, which is then applied to the gummed glass plate after flowing the latter with the "stock solution." Again lightly squeegee, and remove the paraffin sheet.

A less rapid solution, but one which will be safe in the case of an old or hardened negative, is :—

Methylated spirit	1 oz	80 c.c.s.
Water	2 ozs.	160 c.c.s.
Hydrofluoric acid	60 minims	10 c.c.s.

These proportions may be slightly altered for different commercial spirits and acids

Film Negatives.

Caustic soda	10 grs.	23 gms.
Formaline	10 minims	20 c.c.s.
Water	1 oz.	1000 c.c.s.

The celluloid negative is immersed in this solution until the film shows signs of detachment and can be rolled back with the finger. It is then placed in

Hydrochloric acid	25 minims	50 c.c.s.
Glycerine	25 minims	50 c.c.s.
Water	1 oz.	1000 c.c.s.

in which it is removed from its original support to a glass or other base.

WET COLLODION AND COLLODION EMULSION.

Wet Collodion.

PYROXYLINE (HARDWICH).

Sulphuric acid, 1·845	.. ..	18 ozs. (fl.)	600 c.c.s.
Nitric acid, 1·457	.. ..	6 ozs. (fl.)	200 c.c.s.
Water	.. ..	5·5½ ozs. (fl.)	167·182 c.c.s.
Cotton-wool	.. ..	300 grs.	23 gms.

Temperature, 150 degrees F. (65 degrees C) Time of immersion
ten minutes

IODISED COLLODION.

For Acid Pyro Developer.

Ether, specific gravity 0·725	.. ..	10 ozs. (fl.)	1000 c.c.s.
Alcohol, specific gravity 0·805	.. ..	4 ozs. (fl.)	400 c.c.s.
Pyroxyline	.. ..	120 grs.	27 gms.
Ammonium iodide	.. ..	30 grs.	7 gms.
Cadmium iodide	.. ..	45 grs.	10 gms.
Alcohol (0·830)	.. ..	4 ozs. (fl.)	400 c.c.s.

BROMO-IODISED COLLODION.

For Iron Developer.

Ether, specific gravity 0·725	.. ..	10 ozs. (fl.)	1000 c.c.s.
Alcohol, specific gravity 0·805	.. ..	5 ozs. (fl.)	500 c.c.s.
Pyroxyline	.. ..	120 grs.	27 gms.
Ammonium iodide	.. ..	40 grs.	9 gms.
Cadmium iodide	.. ..	40 grs.	9 gms.
• Cadmium bromide	.. ..	20 grs.	4·5 gms.
Alcohol (0·830)	.. ..	5 ozs. (fl.)	500 c.c.s.

Thinning Collodion after Use.—A mixture of sulphuric ether (0·720), 3 parts, and alcohol (0·805), 2 parts, is generally used.

THE NITRATE BATH.

Silver nitrate	.. ..	6 ozs.	75 gms.
Distilled water	.. ..	80 ozs. (fl.)	1000 c.c.s.
Nitric acid (pure)	.. ..	8 minims	0·2 c.c.s.

Saturate with iodide of silver, which may be done by coating a plate with collodion and leaving it in the bath for some hours. Filter.

DEVELOPER.

No. 1. Ferrous sulphate	.. ..	½ oz.	50 gms.
Glacial acetic acid	.. ..	½ oz.	50 c.c.s.
Alcohol	.. ..	½ oz.	50 c.c.s.
Water	.. ..	10 ozs.	1000 c.c.s.
No. 2. Ferrous ammonio-sulphate	.. ..	75 grs.	43 gms.
Glacial acetic acid	.. ..	75 grs.	43 gms.
Copper sulphate	.. ..	7 grs.	4 gms.
Water	.. ..	4 ozs.	1000 c.c.s.
Alcohol	.. ..	¼ oz.	60 c.c.s.

INTENSIFIER.

Pyrogallie acid	90 grs.	10 gms.
Citric acid	60 grs.	7 gms.
Acetic acid (glacial)	1 oz.	50 c.c.s.
Water	20 ozs	1000 c.c.s.

The copper intensifier (see "Intensifiers") is used for greater density, each solution being flowed over the plate with a rinse between.

Positives and Ferrotypes by Wet Collodion.

BROMO-IODISED COLLODION.

Ether, specific gravity 0.725 ..	10 ozs. (fl.)	1000 c.c.s.
Alcohol, specific gravity 0.805 ..	5 ozs. (fl.)	500 c.c.s.
Pyroxyline	100 grs.	23 gms.
Cadmium iodide	50 grs.	11½ gms.
Ammonium bromide	25 grs.	5 gms.
Alcohol, 0.830	5 ozs. (fl.)	500 c.c.s.

Note.—The iodides should be dissolved in the weaker spirit, and the pyroxyline in the ether and stronger spirit, and the two solutions mixed.

SILVER BATH.

Silver nitrate (recryst.)	5½ ozs.	70 gms.
Distilled water	80 ozs. (fl.)	1000 c.c.s.
Nitric acid (pure)	½ drachm	0.8 c.c.

Saturate with iodide of silver and filter as above.

DEVELOPERS.

Ferrous sulphate	150 grs	34 gms.
Glacial acetic acid	½ oz.	50 c.c.s.
Nitric acid	5 minims	1 c.c.
Alcohol	½ oz.	50 c.c.s.
Water	10 ozs.	1000 c.c.s.

Note.—By increasing the proportion of nitric acid and decreasing that of the acetic, the image will be more metallic in appearance.

NITRATE OF IRON DEVELOPER.

Ferrous sulphate	1½ oz.	75 gms.
Barium nitrate	1 oz.	50 gms.
Water	20 ozs.	1000 c.c.s.
Alcohol	1 oz.	50 c.c.s.
Nitric acid	40 drops	4 c.c.s.

The insoluble barium sulphate which is formed must be filtered out.

FIXING SOLUTION.

Potassium cyanide	½ oz.	25-30 gms.
Water	15-20 ozs.	1000 c.c.s.

DEVELOPER FOR COLLODION TRANSFERS.

Pyrogallie acid	.. .. .	4 grs.	9 gms.
Citric acid	.. .. .	3 grs.	7 gms.
Acetic acid	.. .. .	20 minims	41 c.c.s.
Water	.. .. .	1 oz	1000 c.c.s.
Alcohol	.. .. .	20 minims	41 c.c.s.

Wet Collodion for Half-Tone.

EDER'S FORMULÆ

Cadmium iodide	.. .. .	108 grs.	7 gms.
Ammonium iodide	.. .. .	50 grs.	3.2 gms.
Ammonium bromide	.. .. .	18½ grs.	1.2 gm.
Alcohol	.. .. .	6 ozs.	170 c.c.s.
Raw collodion 2%	.. .. .	18 ozs.	510 c.c.s.
Or equal parts of above and			
Strontium iodide	.. .. .	154 grs.	10 gms.
Cadmium bromide	.. .. .	68 grs.	1.8 gm.
Alcohol	.. .. .	7 ozs.	200 c.c.s.
Collodion 2%	.. .. .	21 ozs.	600 c.c.s.
The developer specially recommended for above is -			
Ferrous sulphate	.. .. .	288 grs.	30 gms.
Copper sulphate	.. .. .	192 grs.	16 gms.
Glacial acetic acid	.. .. .	1 oz	50 c.c.s.
Alcohol	.. .. .	¼ oz	30 c.c.s.
Water	.. .. .	20 ozs.	1000 c.c.s.

Collodion Emulsion.

PYROXYLINE FOR COLLODIO-BROMIDE OR UNWASHED EMULSION

Nitric acid, specific gravity 1.45	2 ozs. (fl)	285 c.c.s.
Sulphuric acid, specific gravity 1.845	.. .. .	4 ozs.
Water	.. .. .	1 z. (fl)
Cotton (cleaned and carded)	.. .. .	100 grs.
Temperature, 150 degrees F. (65 degrees C.). Time of immersion 10 minutes.		

FOR WASHED EMULSION.

Nitric acid, specific gravity 1.45.	2 ozs. (fl.)	400 c.c.s.
Sulphuric acid, specific gravity 1.845	.. .. .	3 ozs.
White blotting-paper	.. .. .	145 grs.
Temperature, 100 degrees F. (38 degrees C.). Time of immersion 30 minutes.		

COLLODIO-BROMIDE EMULSION.

Ether, specific gravity 0.720	.. .. .	5 ozs. (fl)	620 c.c.s.
Alcohol, specific gravity 0.820	.. .. .	3 ozs.	380 c.c.s.
Pyroxyline..	.. .. .	50 grs.	14.3 gms.
Cadmium ammonium bromide..	.. .. .	80 grs.	23 gms
or			
Zinc bromide	.. .. .	76 grs.	21.5 gms.

Sensitise by adding to each ounce 15 grs. of nitrate of silver dissolved in a few drops of water and 1 drachm of boiling alcohol. This is suitable for slow landscape work or for transparencies.

WASHED EMULSION (for Transparencies).

Ether, specific gravity 0.720	..	5 ozs (fl)	620 c.c.s.
Alcohol specific gravity 0.820	..	3 ozs.	380 c.c.s.
Pyroxyline or papyroxyline	..	60 grs.	17 gms.
Cadmium ammonium bromide	..	100 grs.	29 gms.
or			
Zinc bromide	.. ..	96 grs.	27.5 gms
Hydrochloric acid (specific gravity 1.2)	.. ..	8 minims	2 c.c.s.

Sensitise with 20 grs. of silver nitrate to each ounce (4.3 grs. to each 100 c.c.s.), dissolved in a minimum of water with 2 drachms (13 c.c.s.) of boiling alcohol. Allow to stand for two or three days.

N.B.—In the last formula, the emulsion, after being allowed to ripen for the time stated, should be poured into a dish and allowed to become thoroughly dry. The mass of dry emulsion is then washed to remove all the soluble salts, and is then again dried and redissolved in equal parts of ether and alcohol, at the rate of from 20 to 24 grs. to the ounce of solvents.

WELLINGTON'S COLLOIDIO-BROMIDE EMULSION FORMULA.

Pyroxyline	.. ..	30 grs.	23 gms.
Ether	.. ..	12 drachms	500 c.c.s.
Alcohol	.. ..	12 drachms	500 c.c.s.

To bromise, add 30 grs. (33 gm.) bromide ammonium dissolved in 45 minims (31 c.c.s. water), to which 4 drachms (170 c.c.s.) of alcohol are afterwards added; 50 grs. (33 gms.) of nitrate of silver dissolved in a drachm (4½ c.c.s.) of water are then added. After washing and drying, the pellicle is dissolved in 1½ oz. (58 c.c.s.) of ether, and the same of alcohol.

Developer.

An excellent developer for collodion emulsion is the following, worked out by the Bolt Court School of Photo-Engraving, London:—

Glycin	.. ..	1 oz.	10 gms.
Sodium sulphite	.. ..	2½ ozs.	25 gms.
Potass. carbonate	.. ..	5 ozs.	50 gms.
Potass. bromide	.. ..	30 grs.	0.7 gm.
Water to	.. ..	30 ozs.	300 c.c.s

INTENSIFYING SOLUTION FOR COLLODION EMULSION.

Silver nitrate	.. ..	60 grs.	70 gms.
Citric acid	.. ..	30 grs.	35 gms.
Nitric acid	.. ..	30 minims	35 c.c.s.
Water	.. ..	2 ozs.	1000 c.c.s.

To each drachm of a three-grain solution of pyrogallie acid add 2 or 3 minims of the above, and apply until sufficient density is attained.

HÜBL'S CHLOR-BROMIDE COLLODION EMULSION.

Special for Colour Work.

A. Silver nitrate	..	..	480 grs.	50 gms.
Hot distilled water	..	..	1 oz.	50 c.c.s.
Dissolve and add				
Alcohol	..	..	2 ozs.	100 c.c.s.
Nitric acid	..	..	6 drops	10 drops
Shake well, and add to				
4 per cent. collodion	..	..	10 ozs.	500 c.c.s.
Shake till any precipitated pyroxyline is redissolved, and then add in small quantities				
Zinc bromide (pure anhydrous)	..	..	307 grs.	32 gms.
Absolute alcohol	..	..	2½ ozs.	128 c.c.s.
Shaking between each addition; then add				
Nitric acid	..	..	24 minims	1.5 c.c.s.
Hydrochloric acid	..	..	24 minims	1.5 c.c.s.
This should be gently warmed before adding to the collodion. Allow to stand for twenty-four to thirty-six hours, or till the emulsion appears a greyish violet by transmitted light, then add				
Zinc chloride (pure anhydrous)	..	..	77 grs.	3.2 gms.
or sufficient to convert the whole of the uncombined silver nitrate into chloride, which can be tested for with potassium chromate. It is advisable to dissolve the zinc chloride in about four times its volume of acid. The emulsion should then be precipitated by pouring into plenty of water, the threads collected and shaken up with alcohol and drained, and then dissolved in				
Absolute alcohol	..	..	10 ozs.	500 c.c.s.
Ether, washed	..	..	10 ozs.	500 c.c.s.

PLAIN AND ALBUMEN PAPERS.

Plain Paper.

Prepare the plain paper with . .

Ammonium chloride	..	..	60—80 grs.	14—18 gms.
Sodium citrate	..	..	100 grs.	23 gms.
Sodium chloride	..	..	20—30 grs.	4.5—7 gms.
Gelatine	..	..	10 grs.	2 gms.
Distilled water	..	..	10 ozs.	1000 c.c.s.
or—				
Ammonium chloride	..	..	100 grs.	23 gms.
Gelatine	..	..	10 grs.	2 gms.
Water	..	..	10 ozs.	1000 c.c.s.

The gelatine is first swelled in cold water and then dissolved in hot water, and the remaining components of the formula are added. The solution is filtered, and, when still warm, the paper floated upon it for three minutes.

The salted paper is sensitised upon a neutral 45-grain silver bath.

PLATINUM TONING BATH.

Potass. chloroplatinite	.. ..	4.5 grs.	1 gm.
Water	.. ..	10 ozs.	1000 c.c.s.
Nitric acid	.. ..	2-3 drops.	5-10 drops.

Albumen Paper.

SILVER BATH.

Silver nitrate	.. ..	600 grs.	140 gms.
Distilled water	.. ..	10 ozs.	1000 c.c.s.

The bath is made just acid with nitric acid, requiring three or four drops per 10 ozs

TONING BATHS

No. 1. Gold chloride	.. ..	1 gr.	0.3 gm.
Sodium acetate	.. ..	30 grs.	6 gms.
Water	.. ..	8 ozs.	1000 c.c.s.

This must not be used till one day after preparation. It keeps well and gives warm, rich tones.

No. 2 Gold chloride	.. ..	15 grs.	1 gm.
Water	.. ..	4 ozs.	120 c.c.s.

Add lime water until a piece of red litmus paper, placed in the solution, is turned blue. Then add--

Calcium chloride, fused	.. ..	120 grs.	7.7 gms.
Water to make	.. ..	7½ ozs.	115 c.c.s.

This solution is diluted with 15 times its volume of water to make the toning bath; it can be used over and over again by addition of stock solution.

PRESERVATIVE FOR SENSITISED ALBUMEN PAPER.

Sensitise the paper in the usual bath, drain well, and when superficially dry float the back of the paper for twenty minutes on a solution of--

Citric acid	.. ..	1 oz.	33 gms
Water	.. ..	30 ozs.	1000 c.c.s

To Prevent Blisters in Albumen Prints.

Before wetting the prints immerse them in methylated spirit, then wash and tone as usual.

GELATINE P.O.P.

Emulsion Formulae.

BARKER'S.

Gelatine (Nelson's No. 1 and

Coignet's, equal parts) ..	175 grs.	80 grms.
Ammonium chloride	18 grs.	8 grms.
Rochelle salts	50 grs.	23 grms.
Silver nitrate	75 grs.	34 grms.
Alcohol	4 drachms	160 c.c.s.
Water	5 ozs.	1000 c.c.

Heat to 100 degrees F (38 degrees C), and allow to remain at this temperature after all is dissolved for ten minutes, after which proceed in the usual way.

VALENTA'S.

A. Silver nitrate	480 grs.	32 grms.
Citric acid	120 grs.	8 grms.
Hot water	5½ ozs.	160 c.c.s.
B. Gelatine	1440 grs.	96 grms.
Ammonium chloride ..	42 grs.	2.8 grms.
Water	24 3 ozs.	700 grms.
C. Tartaric acid	42 grs.	2.8 grms.
Sodium bicarbonate ..	21 grs.	1.4 gm.
Alum	27 grs.	1.8 gm.
Water	5 ozs.	140 c.c.s.

Allow the gelatine to swell in the water and melt by the aid of heat, and add the chloride. Mix B and C at 50 degrees C., and in yellow light add A, heated to the same temperature, in small quantities, shaking thoroughly, and allow the emulsion to ripen for a short time at from 40 degrees to 50 degrees C. and then filter. For matt surface papers the gelatine should be reduced to 754 grs. or 80 grms.

The above formula gives vigorous brilliant prints, but for soft negatives a harder printing emulsion is obtained by adding from 0.05 to 0.1 per cent. of calcium bichromate solution; this can be made by dissolving 480 grs. or 25 grms. of pure chromic acid in 4 ozs. or 100 c.c.s. of distilled water, and adding sufficient pure chalk (calcium carbonate) to make the solution cloudy. The solution should then be filtered, and the filter washed with distilled water up to 4 ozs. or 100 c.c.s.

BEADLE'S.

Nelson's gelatine	340 grs.	112 grms.
Alum	15 5 grs.	5 grms.
Water	6½ ozs.	900 c.c.s.
Rochelle salts	15 5 grs.	3.5 grms.
Ammonium chloride ..	11 grs.	5 grms.
Heat to 50 degrees C., and add --		
Silver nitrate	115 grs.	37.5 grms.
Citric acid	62 grs.	20 grms.
Water	1 oz.	100 c.c.s.

Gold Toning Baths.

SULPHOCYANIDE.

Gold chloride	2½ grs.	·3 gm.
Ammonium sulphocyanide	30 grs.	3·5 gms.
Water	20 ozs.	1000 c c.s.

It is necessary for this and all sulphocyanide baths to ripen. The best method of mixing is to boil the water and to dissolve the gold in one half and the sulphocyanide in the other. Then pour the former into the latter, stirring all the time, and use when cool. If cold water is used, the mixture should be allowed to stand 12 hours.

FORMATE.

Gold chloride .. .	1 gr.	·12 gm.
Sodium bicarbonate .. .	2 grs	·23 gm
Sodium formate .. .	8 grs	9 gm
Water	20 ozs.	1000 c c.s.

The prints must be immersed in a 10 % solution of salt and water before using this bath.

TUNGSTATE.

Sodium tungstate .. .	30 grs.	3·5 gms.
Sodium carbonate .. .	1 gr.	·12 gm.
Gold chloride .. .	1 gr.	·12 gm.
Water	10-20 ozs	500-1000 c.c.s.,

CONCENTRATED SULPHOCYANIDE.

(Buhler's Formula.)

A. Distilled water	1 oz.	150 c.c.s.
Gold chloride	15 grs.	5 gms
B. Strontium chloride	150 grs.	50 gms.
Distilled water	¾ oz.	100 c.c.s.
C. Potassium sulphocyanide	80-150 grs	25-50 gms
Distilled water	1½ oz.	250 c.c.s

Heat B to boiling, and add A (heated to 150 degrees F.) in small doses. Bring C to boiling, and allow to cool to 205 degrees F., and add the hot mixture of A and B in four or five lots with constant stirring; cool and filter. If a precipitate forms, reheat to nearly boiling, wash the filter with ¼ oz (100 c.c.s.) water, and add this latter to the total bulk. The bath is diluted with 10 times its volume of water for use.

THIOCARBAMIDE

Gold chloride	4 grs.	25 gm.
Distilled water	1 oz.	25 c.c.s.
Add, to dissolve precipitate first formed, sufficient of.—		
Thiocarbamide	90 grs.	1 gm.
Distilled water	10 ozs.	50 c.c.s.
About ¾ oz (14 to 15 c c s.) will be needed. Next add:—		
Citric acid	8 grs.	·5 gm.
and		
Distilled water to	35 ozs.	1000 c.c.s.
and finally		
Salt	160 grs.	10 gms

The prints should be thoroughly washed *before* as well as *after* fixing.

SHORT STOP FOR GOLD TONING.

A weak solution of sodium sulphite (5 grs. per oz.) at once arrests the action of a gold toning bath.

SALT BATH

A short immersion of prints in the following bath prior to the first washing favours even toning and prevents spots and stains from rusty tap water :—

Salt	2 oz.	100 gms.
Sodium carbonate	1 oz.	50 gms.
Water	20 oz.	1000 c.c.s.

If prints are to be toned in the platinum bath the carbonate should be omitted.

Platinum Toning Baths.

PHOSPHORIC ACID.

Potass chloroplatinite	4 grs.	45 gm
Phosphoric acid (sp. gr. 1.12) .. .	1 oz. (tl)	35 c.c.s.
Water to	20 oz.	1000 c.c.s.

CITRIC ACID

Potass chloroplatinite	4 grs.	45 gm
Sodium chloride (salt)	40 grs.	45 gms.
Citric acid	50 grs.	58 gms.
Water to	20 oz.	1000 c.c.s.

HADDON'S FORMULA.

Platinum perchloride	3 grs	2 gm
Sodium formate	100 grs.	65 gms.
Formic acid	30 minims	1.8 c.c.
Water to	35 oz.	1000 c.c.s.

SHORT STOP FOR PLATINUM TONING.

A weak solution of sodium carbonate (10 grs. per oz.) instantly arrests the toning action of a platinum bath.

FOR BLACK TONES.

Tone in (Valenta)

Potass chloroplatinite	2½-10 grs	5.2 gm.
Metaphenylenediamine	2½-10 grs.	5.2 gm.
Water	10 oz.	1000 c.c.s.

having first washed the prints well.

Another method is to print deeply and immerse the prints in .—

Salt	1 oz.	25 gms.
Sodium bicarbonate	80 grs.	9 gms.
Water	20 oz.	1000 c.c.s.

then wash well and tone in a borax gold bath to a purple red. Again well wash and tone in the phosphoric platinum bath

FOR RED.

(Valenta.)

Uranium nitrate	10.20 grs	1.2 gms.
Thiosinamine	90 grs.	10 gms.
Water	20 ozs	1000 c.c.s.

The prints are well washed, finally in water acidulated with acetic acid, and then toned. They are afterwards fixed, or can be toned to sepia brown in the combined bath.

GOLD PLATINUM (One Solution).

Citric acid	90 grs.	10 gms.
Salt	90 grs.	10 gms.
Potass chloroplatinite	4.8 grs.	$\frac{1}{2}$ -1 gm.
Gold chloride	4.8 grs.	$\frac{1}{2}$ -1 gm.
Water	20 ozs.	1000 c.c.s.

Twice the amount of water may be used if the bath acts too quickly. If the proportion of gold to platinum is increased the tone is warmer. The prints must be well washed before fixing.

Combined Baths.

VALENTA'S.

Hypo	8 ozs	400 gms.
Ammonium sulphocyanide	1 oz.	50 gms.
Lead-nitrate	175 grs.	20 gms.
Alum	350 grs.	40 gms.
Water to	20 ozs.	1000 c.c.s.

Dissolve the hypo in the water, add the sulphocyanide, then add the alum dissolved in a little water, and also the lead, and add to the hypo. Heat the mixture to 120° F. for ten minutes; allow to cool. For use take

Stock solution (as above)	10 ozs.	100 c.c.s.
Water	10 ozs.	100 c.c.s.
Gold chloride (from stock sol.)	$3\frac{1}{2}$ grs.	0.23 gm.

ALKALINE TONING AND FIXING BATH

Gold chloride	2 grs.	0.23 gm.
Lead nitrate	10 grs.	1.2 gm.
Chalk	$\frac{1}{2}$ oz.	25 gms.
Hypo	4 ozs.	200 gms
Water	20 ozs.	1000 c.c.s.

Shake the solution well, allow to settle, and use the clear portion

Reducer for Over-printed Proofs.

A. Ammonium sulphocyanide	10% sol.
B. Potass ferricyanide	10% sol.
A, 5 ozs.; B, $\frac{1}{2}$ oz.; water, 24 ozs.	

Developing P.O.P.

DIRECT PROCESS WITH ACID DEVELOPER.

Hydroquinone	16 grs.	18.5 gms.
Citric acid	40 grs.	4.6 gms.
Sodium acetate	1 oz.	50 gms.
Water	20 ozs.	1000 c.c.s.

Immerse the dry prints in the developer, and, after development, wash in plenty of water for ten or fifteen minutes, then tone in the usual way.

Pyro (Blacklock).

A. Pyro	40 grs.	4.6 gms.
Tartaric acid	40 grs.	4.6 gms.
Water	20 ozs.	1000 c.c.s.

Will keep three or four weeks.

B. Potass bichromate	$\frac{1}{16}$ gr.	0.009 gm.
Water	16 ozs.	1000 c.c.s.

B is best made up from a stock solution of 1 gr. per ounce, adding $\frac{1}{2}$ drachm of it to 16 ozs. of water. To develop, mix equal parts of A and B.

Six or seven inches of magnesium ribbon burnt close to the frame will suffice for the exposure.

The fixing bath is:—

Hypo	3 $\frac{1}{2}$ ozs.	160 gms.
Lead acetate	200 grs.	23 gms.
Water	20 ozs.	1000 c.c.s.

in which the prints lose very little.

PAGET "BROMIDE" PROCESS.

The prints are immersed in 10 per cent. potass bromide solution for five or ten minutes, washed and developed with the following:—

A. Hydroquinone	40 grs.	4.5 gms.
Sodium sulphite	160 grs.	18 gms.
Water to	20 ozs.	1000 c.c.s.
B. Potass bromide	2 $\frac{1}{2}$ ozs.	125 gms.
Sodium carbonate	2 ozs.	100 gms.
Water to	20 ozs.	1000 c.c.s.

For average negatives mix. A, $\frac{1}{2}$ oz.; B, 1 oz.; water, $\frac{1}{2}$ oz.

For flat negatives (greater contrast). A, 3 drachms; B, 1 oz.; water, 5 drachms.

For hard negatives (soft results), say, A, 7 drachms; B, 1 oz.; water, 1 drachm.

Glazing P.O.P.

A polishing medium to be applied to glass or ferrotype before squeegeeing the print is:—

Beeswax	20 grs.	45 gms.
Turpentine	1 oz.	1000 c.c.s.
or		
Spermaceti wax	20 grs.	45 gms.
Benzole	1 oz.	1000 c.c.s.

a few drops of which are rubbed on with a piece of flannel, and the glass afterwards polished with silk rag or chamois leather.

ENAMEL COLLODION.

Soluble gun cotton	.. ..	50 grs.	14 gms.
Alcohol	.. ..	4 ozs.	500 c.c.s.
Sulphuric ether	.. ..	4 ozs.	500 c.c.s.

Glass plates cleaned with French chalk are coated with the above, and, as soon as coating has set, slip under prints which are waiting face down in water. Prints are withdrawn, squeegeed, and when half dry given a backing paper. (For both gelatine and collodion prints.)

COLLODIO=CHLORIDE P.O.P.

Emulsion Formula.

(Valenta.)

1. Strontium chloride	.. ..	154 grs.	10 gms.
Lithium chloride	.. ..	77 grs.	5 gms.
Water	.. ..	500 minims	30 c.c.s.
Alcohol (absolute)	.. ..	930 minims	55 c.c.s.
2. Silver nitrate	.. ..	400 grs.	20 gms.
Water	.. ..	500 minims	30 c.c.s.
Alcohol	.. ..	1000 minims	60 c.c.s.
3. Citric acid	.. ..	77 grs.	5 gms.
Alcohol	.. ..	675 minims	40 c.c.s.
Glycerine	.. ..	92 grs.	6 gms.

In a bottle capable of holding 1000 parts pour 350 parts of 3 per cent. collodion and add gradually 15 parts of No. 1. Then in the dark room add almost drop by drop 60 parts of No. 2, shaking well after each addition; then add 50 parts of No. 3 and 50 parts of ether. This collodion is suitable for normal negatives, but more contrast can be obtained if 0.1 to 0.4 per cent. calcium chromate solution is added. By reducing the amount of pyroxylene in the above formula the emulsion is more suitable for matt surface paper.

Gold Toning Baths.

BORAX-ACETATE.

Borax	.. ..	90 grs.	10 gms.
Sodium acetate	.. ..	90 grs.	10 gms.
Gold chloride	.. ..	2½ grs.	0.3 gm.
Water	.. ..	20 ozs.	1000 c.c.s.

SULPHOCYANIDE.

Ammonium sulphocyanide	.. ..	90 grs.	10 gms.
Gold chloride	.. ..	2½ grs.	0.3 gm.
Water	.. ..	20 ozs.	1000 c.c.s.

For bluish-black tones.

SULPHOCYANIDE-ACETATE.

Ammonium sulphocyanide	..	35 grs.	4 gms.
Sodium acetate	.. ..	$\frac{3}{4}$ oz.	45 gms.
Gold chloride	.. ..	5 grs.	0.6 gm.
Water	.. ..	20 ozs.	1000 c.c.s.

Is made up one hour before using, preferably from stock solutions of the substances. With sodium tungstate, instead of the acetate, gives fine chestnut tones.

The maker's formulæ should be studied in connection with the above baths as papers differ considerably in the quantity of gold required in the toning solution.

Platinum Toning Baths.

The phosphate formula given below under "Gold Platinum Toning" is suitable for the production of the warm brown and sepia tones, which are given by the platinum baths alone. Others are—

Citric acid	.. ..	45 grs.	5 gms.
Potass chloroplatinite	.. ..	4 grs.	0.5 gm.
Water	.. ..	20 ozs.	1000 c.s.
and			
Lactic acid (specific gravity 1.21)	.. ..	25 grs.	3 gms.
Potass chloroplatinite	.. ..	4 grs.	0.5 gm.
Water	.. ..	20 ozs.	1000 c.c.s.

SALT-BICARBONATE BATH.

The following is used between washing and toning with the platinum bath as a means of removing free silver, and bringing the prints into a state of regular neutrality.—

Salt	.. ..	$\frac{1}{4}$ oz.	25 gms.
Sodium bicarbonate	.. ..	45 grs.	5 gms.
Water	.. ..	20 ozs.	1000 c.c.s.

Gold-Platinum Toning.

For Black Tones.

Wash in several changes, and tone the shadows to a brown (when seen by transmitted light) in the following:—

Borax	.. ..	90 grs.	10 gms.
Gold chloride	.. ..	2 grs.	0.2 gm.
Water	.. ..	20 ozs.	1000 c.c.s.

This bath is ready within a few minutes of mixing. It is conveniently made just before washing the prints. The quantity of borax is adjusted to the working. If the lighter tones disappear, add more borax; if the prints lack brilliance, add gold. After a ten-minute wash, transfer to the platinum bath, which may be strong or weak, the only difference being that a larger number of prints may be treated together in the weaker bath.

Stock solution.—

Potass chloroplatinite	30 grs.	7 gms.
Phosphoric acid (specific gravity 1·12)	5 drachms	30 c.c.s.
Water to make	20 ozs.	1000 c.c.s.

This may be made up to 60 ozs. at once, or added little by little to water, as the prints are passed through a few at a time.

The prints are next washed in about eight changes of water (to the fifth or so of which it is well to add a little of bicarbonate of soda to neutralise traces of acid) before fixing.

For Warm Sepia Tones.

The prints are washed in three changes of warm water and placed in . . .

Ammonia	1 drachm	6 c.c.s.
Warm water	20 oz.	1000 c.c.s.

until they become lemon yellow. They are then again washed in three changes of water and toned for about one minute in the gold borax bath above.

For Red Chalk Tones.

The prints are washed in a couple of changes of water and placed for about half an hour (until they become orange-yellow) in :—

Salt	1 oz.	50 gms.
Water	20 oz.	1000 c.c.s.

After which they are washed for about one minute and toned, for a few seconds only, in the borax bath above.

For Violet Tones.

Print deeply from the negatives and tone until the colour desired is reached in :—

Hydrochloric acid	6 oz.	300 c.c.s.
Gold chloride	10 grs.	1·2 gm.
Water to make	20 oz.	1000 c.c.s.

After which wash thoroughly and fix in 5 per cent. hypo. Less acid in the above bath tends to blue-violet, more to violet purple.

Combined Baths.

Collodion papers, although not generally so suitable for use with the combined bath, may in many cases be toned in it. The Valenta formula (see "Gelatine P.O.P." above) is suitable, also the following (Kurz).—

Water	20 ozs.	1000 c.c.s.
Hypo	5 ozs.	250 gms.
Ammonium sulphocyanide ..	240 grs.	28 gms.
Alum	70 grs.	7·5 gms.
Citric acid	70 grs.	7·5 gms.
Lead nitrate	90 grs.	10 gms.
Lead acetate	90 grs.	10 gms.
Gold chloride	3½ grs.	0·4 gm.

It is turbid when first made, but clears after a few days.

BROMIDE AND GASLIGHT PAPERS.

The following developers are a few only of the standard. The "Makers' Formulae" should be consulted.

Amidol.

Sodium sulphite	650 grs.	74 gms.
Potass bromide	10 grs.	1.2 gm.
Water	20 ozs.	1000 c.c.s.

When dissolved add—

Amidol	50 grs.	5.7 gms.
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This developer will not keep more than three days.

See also the formula given under "Negative Developers."

The most convenient and economical method of using amidol developer for bromide papers is to make up a 10 per cent. stock solution of sodium sulphite, and add 5 grs. potassium bromide to each 10 ozs. solution. For use add 4 grs. dry amidol to each ounce stock solution, and dilute with an equal bulk of water.

Metol.

A. Metol	100 grs.	11.5 gms.
Sodium sulphite	2 ozs.	100 gms.
Potass bromide	12 grs.	1.4 gm.
Water	20 ozs.	1000 c.c.s.
B. Potass carbonate	2 ozs.	100 gms.
Water	20 ozs.	1000 c.c.s.

For use take 3 ozs. of A and 1 oz. of B.

For gaslight papers use half the quantity of water in above formula.

Metol-Hydroquinone.

Metol	8 grs.	1 gm.
Hydroquinone	30 grs.	3.5 gms.
Sodium sulphite	$\frac{3}{4}$ oz.	37.5 gms.
Sodium carbonate	$\frac{1}{4}$ oz.	37.5 gms.
10% solution of potass bromide ..	20 minims	2.5 c.c.s.
Water	20 ozs.	1000 c.c.s.

For gaslight papers make up above formula with 10 ozs. of water.

Rodinal.

Rodinal	100-150 minims	6.9 c.c.s.
Water	10 ozs.	300 c.c.s.
10% solution of potass bromide ..	20 minims	1 c.c.

Ortol.

A. Ortol	.. ..	120 grs.	14 gms.
Potass. metabisulphite	.. ..	60 grs	7 gms.
Water	.. ..	20 ozs.	1000 c.c.s
B. Sodium sulphite	.. ..	4 ozs.	200 gms.
Potass. carbonate	.. ..	1 oz.	100 gms.
Potass. bromide	.. ..	20 grs.	2.3 gms.
Water	.. ..	20 ozs.	1000 c.c.f.

Use equal parts of A and B.

For gaslight papers use half the quantity of water given in this formula.

Ferrous Oxalate.

A. Sulphate of iron	.. ..	5 ozs.	250 gms.
Sulphuric acid	.. ..	30 minims	3 c.c.s.
Warm water to	.. ..	20 ozs.	1000 c.c.s.
B. Potass. oxalate (neutral)	.. ..	5 ozs.	250 gms.
Potass. bromide	.. ..	10 grs.	1.2 gm.
Warm water to	.. ..	20 ozs.	1000 c.c.s.

For use add 1 oz. of A to 4 ozs. of B, not *vice versa*

After development and without washing, immerse the prints for two minutes in acid bath, pour off and repeat.

ACID BATH.

Glacial acetic acid	.. ..	1 drachm	6 c.c.s.
Water	.. ..	20 ozs.	1000 c.c.s.

Then wash thoroughly to remove last trace of acid.

Clearing Bath.

To remove yellow stain from bromide prints, the following is suitable:—

Alum (saturated solution)	.. ..	10 ozs.	1000 c.c.s.
Hydrochloric acid	.. ..	3 drms.	40 c.c.s.

Reducer for Bromides.

Over-developed prints are best treated in a weak iodine-cyanide reducer made from (A) 10% solution of iodine in potass. iodide and (B) 10% potass cyanide solution. Take:—

A.	.. ..	30 minims	2 c.c.s.
B.	.. ..	10 minims	0.6 c.c.
Water	.. ..	2 ozs.	60 c.c.s.

Adding more of A and B if necessary.

Strong Prints from Flat Negatives.

The prints are fully exposed and over-developed, fixed and washed, They are then placed in the following iodine bath until whites are strongly blue, and then fixed for five minutes.

IODINE BATH

Potass. iodide	..	..	..	30 grs.	7 gms.
Iodine	..	..	..	3 grs.	0.7 gms.
Water	..	..	..	10 ozs.	1000 c.c.s.

If not sufficiently lightened, the print may be washed and the process with bleaching bath and hypo repeated.

Hypo-Alum Toning.

Hot water	20 ozs.	1000 c.c.s.
Hypo	2½ ozs.	125 gms.

Dissolve and add

Alum	½ oz.	25 gms.
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This solution should not be filtered, and it works better as it becomes older; it may be strengthened from time to time with a little fresh solution.

The best results are obtained by keeping the bath hot, or as warm as the emulsion will stand, say 100 to 120 degrees F. In this bath prints will tone in 30 to 40 minutes. When this toning bath is to be employed, the use of the alum bath after fixing is absolutely essential. Moreover, the prints should not, in this case, be subjected to a prolonged washing, but should only be slightly rinsed before being dried.

A new bath tends to reduce the prints rather more than an old one.

- When toned the prints should be placed in a tepid solution of—

Water	..	..	..	70 ozs.	1000 c.c.s.
Alum	..	..	..	2 ozs.	30 gms.

and then washed thoroughly.

Sulphide Toning.

A. Ammonium bromide	..	..	300 grs.	35 gms.
Potass. ferricyanide	..	..	300 grs.	35 gms.
Water	..	..	20 ozs.	1000 c.c.s.
B. Sodium sulphide (pure)	..	..	100 grs.	12 gms.
Water	..	..	20 ozs.	1000 c.c.s.

Bleach the fixed and washed print in A solution. Wash for a few minutes in water, and then immerse in B solution until toned. The print is then well washed and dried.

Copper Toning.

A. Copper sulphate	60 grs.	7 gms.
Potass. citrate (neutral)	240 grs.	28 gms.
Water	20 ozs.	1000 c.c.s.
B. Potass. ferricyanide	50 grs.	6 gms.
Potass. citrate (neutral)	240 grs.	28 gms.
Water	20 ozs.	1000 c.c.s.

Use equal parts of each. Warm black to red chalk tones are obtained.

Platinum Toning.

Not for Gaslight Prints.

Potass chloroplatinite	12 grs.	0.8 gm.
Mercuric chloride	6 grs.	0.4 gm.
Citric acid	54 grs.	3.4 gms.
Water	6 ozs.	170 c.c.s.

This bath should be made up fresh for use from stock solutions. Gives warm sepia tones, with slight staining of high-lights. For cold sepia tones and absence of staining add 30 minims 10 per cent solution potassium bromide to above. Wash well after toning.

Uranium Toning.

A. Uranium nitrate	90 grs.	10 gms.
Water	20 ozs.	1000 c.c.s.
B. Potass. ferricyanide	90 grs.	10 gms.
Water	20 ozs.	1000 c.c.s.

Use equal parts of A and B, and add 20 minims of glacial acetic acid to each ounce of mixture. The prints must be free from hypo. After toning wash in several changes of *still* water till the high-lights are clear. Washing in running water will remove the toning in patches. Citric acid (10 grs. per oz.) or oxalic acid (5 grs. per oz.) instead of acetic is an aid to pure whites. This bath intensifies the image.

Green Tones.

Vanadium chloride	20 grs.	1 gm.
Ferric chloride	10 grs.	0.5 gm.
Ferric oxalate	10 grs.	0.5 gm.
Potassium ferricyanide	20 grs.	1 gm.
Oxalic acid (sat. sol.)	2½ ozs.	60 c.c.s.
Water to	20 ozs.	1000 c.c.s.

Dissolve the vanadium salt in hot hydrochloric acid and a little water. Add the ferric chloride and oxalate to the oxalic acid solution diluted with half the water, then add the ferricyanide dissolved in water, stirring well, and finally the vanadium. Tone till the prints turn blue, and then wash till they are green. Yellowish stain of the whites is removed by a weak (2 gr. per oz.) solution of ammonium sulphocyanide.

Blue Tones.

10% solution ferric ammonium citrate	2 ozs	10 c.c.s.
10% solution potassium ferricyanide	2 ozs.	10 c.c.s.
10% solution acetic acid.. .. .	20 ozs.	100 c.c.s.

The well-washed prints are immersed in this bath until the desired tone is given. Then well wash until high-lights are clear. This bath intensifies the image.

Gold Toning.

Ammonium sulphocyanide	30 grs.	2 gms.
Chloride of gold	2 grs.	0.13 gm.
Boiling water	4 ozs.	110 c.c.s.

Use as soon as cool. Place the wet print face upwards on a sheet of glass, squeegee into contact, blot off superfluous moisture, and paint the above bath on with a broad flat brush; when the desired tone is reached wash well and dry. This considerably improves the colour of greenish or rusty black prints, and if allowed to act for some time bluish tones are obtained.

Practically all the above toning solutions can be employed for lantern plates.

Line Drawings from Bromide, Gaslight, or P.O.P. Prints.

After outlining the subject in waterproof Indian ink, bleach out the image in—

Thiocarbamide	240 grs.	25 gms.
Nitric acid	4 drachms (fl.)	25 c.c.s.
Water	20 ozs.	1000 c.c.s.

Or in—

Iodine sol. (10 per cent. in potass iodide sol.)	30 minims	6 c.c.s.
Potass cyanide (10 per cent. sol. in water).. .. .	5 minims	1 c.c.
Water	1 oz.	100 c.c.s.

THE CARBON PROCESS.

Sensitising Solutions.

Potass bichromate ..	1 oz.	35.50 gms.
Water	20-30 ozs.	1000 c.c.s.
Liquor ammonia (0.880) ..	60 minims	6 c.c.s.

A longer immersion in the weaker solution is practically equal to a shorter one in the stronger bath.

If the tissue is squeegeed on a glass plate after sensitising, light or heavy squeegeeing also modifies its sensitiveness by removing more or less of the solution. If the tissue be squeegeed on to a ferrotype plate, and allowed to dry upon it, the drying may be done in the light of an ordinary room. The face of the tissue is then protected from light, dust and injurious vapours.

The following has been recommended:—

B. Potass bichromate	1 oz.	20 gms.
Water	50 oz.	1000 c.c.s.
Citric acid	$\frac{1}{4}$ oz.	5 gms.

Liquor ammonia q.s. to change the tint of the solution to a lemon yellow. This bath is suitable for thin negatives, *i.e.*, those lacking in contrasts, and the tissue sensitised in it will keep longer than that sensitised in the former solution. The tissue, however, is much less sensitive, and with vigorous or contrasty negatives, such as are best suited for carbon work, it is apt to yield prints that are hard, through the washing away of the more delicate tones in the development.

Waxing Solutions.

FOR CARBON PRINTS, OR FOR REMOVING COLLODION FILMS.

No. 1. Beeswax	20 grs.	10 gms.
Benzole rect. No. 1	4 ozs.	1000 c.c.f.

FOR FLEXIBLE SUPPORTS (AUTOTYPE).

No 2. Yellow resin	180 grs.	42 gms.
Yellow beeswax	60 grs.	14 gms.
Rectified spirits of turpentine ..	10 ozs.	1000 c.c.s.

Fixing or Hardening Bath.

Alum	1 oz.	50 gms.
Water (1 pint)	20 ozs.	1000 c.c.s.

Gelatine Solutions.

For transferring carbon pictures from flexible support to ivory, opal, glass, &c.

Nelson's No. 1 gelatine	1 oz.	50 gms.
Water	1 pint	1000 c.c.s.
Chrome alum, dissolved in 2 ozs. (100 c.c.s.) hot water	12 grs.	1.4 gm.

For coating drawing-papers for the single transfer process—

Nelson's No. 1 gelatine	1 oz.	50 gms.
Water	1 pint	1000 c.c.s.
Chrome alum, dissolved in 2 ozs. (100 c.c.s.) water	20 grs.	2.3 gms.

Apply with a brush.

Note.—In adding a solution of chrome alum to one of gelatine, both solutions should be at a fairly high temperature, 130 degrees to 160 degrees F.

SUBSTRATUM FOR CARBON TRANSPARENCIES.

Nelson's No. 1 gelatine	3 oz	37 gms.
Water	20 ozs.	1000 c.c. s.
Potass bichromate	12 grs	1.4 gm.

Well cleaned plates are coated with this and dried, when they are fully exposed to light, which will render the coating insoluble.

To Remove Bichromate Stains from the Fingers and Nails after Sensitising.

Apply dilute ammonia to the parts until the stains disappear, then well wash the hands with warm water and soap.

THE BROMOIL PROCESS.

C. Welborne Piper's Formula.

The bromide enlargement must be fully exposed and developed, using a slow acting amidol developer for preference, and it must be thoroughly fixed, washed, and dried. It is then bleached in—

Ozobrome solution	4 parts
Potash alum, 10% solution	4 parts
Citric acid, 10% solution	1 part
Water to make	20 parts

It is washed and then immersed in sulphuric acid (1 part to 20 water) for from 2 to about 5 minutes, again washed by soaking for a few minutes, and then fixed for 2 or three minutes in—

Hypo	2 ozs.
Soda sulphite	$\frac{1}{2}$ oz.
Water to make	20 ozs.

After this it is washed again and then pigmented like an ordinary oil print. The solutions and washing water used should not be under 60 deg or over 70 deg. F., and the preparation of the print should not occupy longer than 20 minutes.

The ozobrome solution used is that specially supplied for bromoil by the Ozobrome Company.

PLATINUM PRINTING.

Sensitisers for Cold Bath Papers (Hübl).

STOCK SOLUTIONS.

Standard Iron Solution —In glass measure about 3 in. diameter and 12 in. high (marked to show a volume of 85 c.c.s.), place 52 gms. powdered iron ammonium alum, and add about 20 c.c.s. ammonia (0.880) and 20 c.c.s. water. Stir up the alum powder with a glass rod, and allow to stand several minutes, with frequent shaking. The whole should smell slightly of ammonia; if it does not a little more is added. The measure is then filled with water, the precipitate of ferric hydroxide stirred up, the glass rod removed, and the ppt. left to settle. The clear liquid is poured off, fresh water poured on, and the stirring and settling repeated until the solution no longer colours red litmus-paper blue. Powdered oxalic acid (21.5 gms.) is then dusted on the ppt., after pouring off the last washing water, and (in yellow light from this point) stirred in until the mixture clears. It is poured into a 100 c.c. measure, and diluted (with rinsings from the cylinder) to 100 c.c.s. Process occupies three to four hours.

Lead-Iron Stock Solution. —Dissolve lead acetate (10 gms.) in warm water (100 c.c.s.), and add oxalic acid (4 gms.) dissolved in a little water. A white precipitate of lead oxalate is produced, and is filtered, washed, and shaken up, with Standard Iron Solution in proportion of 1 gm. per 100 c.c.s. Finally, filter.

Oxalic-Gelatine Solution. —Soak gelatine (2 gms.) in water (20 c.c.s.), and add oxalic acid ($\frac{1}{2}$ gm.). Warm before use. Keeps only a day or two.

Stock Platinum Solution. —Potash chloroplatinite 1 gm.; water, 6 c.c.s.

Mercury Citrate Solution. —Dissolve yellow mercuric oxide (1 gm.) in water, 20 c.c.s.; citric acid, 5 gms., warm and filter.

SENSITISERS.

The quantities are for a 20 by 30 sheet. Water is added for medium (2 to 3 c.c.s.) and for rough (3 to 8 c.c.s.) papers.

A. Lead-iron solution	..	..	..	4.5 c.c.s.
Stock platinum solution	..	..	..	3 c.c.s.

For black tones on gelatine-sized Rives papers.

B. Lead-iron solution	..	..	..	4.5 c.c.s.
Stock platinum solution	..	..	..	3 c.c.s.
Oxalic-gelatine solution	..	..	..	1 c.c.

For blue-black tones on arrowroot-sized papers.

For more brilliant prints 5 to 10 drops of 10% solution of sodium chloroplatinate are added to either of the above.

Sepia Paper Sensitisers.

HOT DEVELOPMENT.

Standard iron solution	6 c.c.s.
Stock platinum solution	4 c.c.s.
Mercuric chloride (1-20 solution)	0.2 to 1 c.c.
Sodium chloroplatinate (10% solution)	2 to 10 drops.

COLD DEVELOPMENT.

Standard iron solution	8 c.c.s.
Stock platinum solution	4 c.c.s.
Mercury citrate solution	1 to 4 c.c.s.
Sodium chloroplatinate (10% solution)	2 to 5 drops.

For rough papers 2 to 4 c.c.s. of water are added.

Cold Bath Developers.

Potass oxalate	2 ozs.	100 gms.
Potass phosphate	1 oz.	50 gms.
Water	20 ozs.	1000 c.c.s.

FOR SEPIA TONES ON COLD BATH BLACK PAPER.

A. Potass oxalate	2 ozs.	20 gms.
Water	15 ozs.	150 c.c.s.
Potass citrate	160 grs.	23 gms.
Citric acid	250 grs.	39 gms.
Mercuric chloride	95 grs.	14 gms.
Water	15 ozs.	1000 c.c.s.

Equal parts of A and B, used slightly warm. The prints are afterwards fixed in acid baths of one-third the usual strength.

Another Formula.

Prepare the following solutions —

1. Potass oxalate	4 ozs.	250 gms.
Distilled water	16 ozs.	1000 c.c.s.
2. Cupric chloride	124 grs.	35 gms.
Distilled water	8 ozs.	1000 c.c.s.
3. Mercuric chloride	1 oz.	62 gms.
Distilled water	16 ozs.	1000 c.c.s.
4. Lead acetate	32 grs.	18 gms.
Distilled water	4 ozs.	1000 c.c.s.

Mix 12 parts of No. 1 with 4 parts No. 2, then add 4 parts No. 3 and 1 part No. 4, and heat till the precipitate first formed is redissolved. The solution should be heated to 175 degrees F., and the prints developed in it in the usual way and treated to the usual acid clearing baths, then immersed in ammonia solution (about 10 minims per oz.) for five minutes, and washed and dried.

Developers for Sepia Paper.

HOT BATH.

Potass oxalate	2 ozs.	100 gms.
Potass phosphate	1 oz.	50 gms.
Citric acid	180 grs.	20 gms.,
Potass chloride	90 grs.	10 gms.
Water	20 ozs.	1000 c.c.s.

COLD BATH.

Potass oxalate	2 to 6 ozs.	100 to 300 gms.
Oxalic acid	90 grs.	10 gms.
Water	20 oz.	1000 c.c.s.
or,		
Potass oxalate	1½ to 6 ozs.	70 to 300 gms.
Potass phosphate	260 grs.	30 gms.
Oxalic acid	90 grs.	10 gms.
Water	20 ozs.	1000 c.c.s.

RECOVERING OVER-EXPOSED PRINTS.

Immerse for about two minutes in the oxalate developer. Transfer for one second to a bath of 1 to 20 hydrochloric acid. Return to the developer, and treat as usual.

INTENSIFIER FOR PLATINUM PRINTS.

A. Sodium formate	45 grs.	100 gms.
Water	1 oz.	1000 c.c.s.
B. Platinum perchloride	10 grs.	1 gm.
Water	1 oz.	45 c.c.s.

Add 15 minims each of A and B to 2 ozs. of water (3 c.c.s. to 100 c.c.s.).

RESTORING YELLOWED PRINTS.

Shake up bleaching powder with about five times its weight of water, pass through a sieve, and to the portion which passes through add a little weak hydrochloric acid—enough to give the mixture a faint chlorine smell. The solution removes the yellow (iron) stain from platinum prints.

CLEANING SOILED PRINTS.

Alum (one teaspoonful) is dissolved in about 8 ozs. of water, and mixed in a basin with a handful of flour to a cream-like consistency. This mixture is applied to the platinum print with a soft brush, and washed off in running water.

PLATINUM RESIDUES.

Exhausted developers—the acid baths will not repay recovery—are mixed in a large jar, with zinc and hydrochloric acid (spirits of salt will do). A dirty chalk-like precipitate is accumulated, and the clear liquor is thrown away. The platinum is precipitated in the mud, and the latter, when enough has accumulated, is sent to the refiners, after being drained from water as much as possible on a linen cloth.

Waste prints, clippings from paper, etc., should be sent as they are or burnt to an ash in a place free from draught, such as a biscuit tin with a row of holes about half way up. They should not be mixed with the wet residues, as the two require different treatment for the extraction of the metal.

IRON PRINTING PROCESSES.

Ferro-Prussiate Sensitiser.

A. Ferric ammonium citrate (green)*	..	..	..	110 grs.	250 grms.
Water	..	..	..	1 oz.	1000 c.c.s.
B. Potass ferricyanide	..	..	..	40 grs	90 grms.
Water	..	..	..	1 oz.	1000 c.c.s.

Mix in equal parts, keep in the dark, and filter just before use.

Solution for Writing Titles on, removing blue lines from blue prints, etc.—Potass oxalate, 75 grs. per oz. ; 170 grms. per 1000 c.c.s.

Brightening the Colour—Blue prints are improved in colour by a final bath of $2\frac{1}{2}$ per cent. alum solution, 3 per cent. oxalic acid, or 1 per cent. hydrochloric acid.

The Kallotype Process.

SENSITISER.

Ferric oxalate	..	..	..	75 grs.	170 grms.
Silver nitrate	..	..	..	30 grs.	70 grms.
Distilled water	..	..	..	1 oz.	1000 c.c.s.

The ferric oxalate is shaken up with the hot water and a grain or two of oxalic acid added to get it into solution. After filtering the silver is added and the solution stored in the dark.

DEVELOPERS.

For black tones.

Borax	..	..	..	2 ozs.	100 grms.
Rochelle salt	..	..	..	1 ozs.	75 grms.
Water	..	..	..	20 ozs.	1000 c.c.s.
Potass bichromate sol. (1%)	..	..	..	15 to 18 drms	90 to 115 c.c.s.

*For purple tones.

Borax	..	..	..	$\frac{1}{2}$ oz.	28 grms.
Rochelle salt	..	..	..	2 ozs.	100 grms.
Water	..	..	..	20 ozs.	1000 c.c.s.
Potass bichromate sol (1 %)	..	..	..	15 to 18 drs.	90 to 115 c.c.s.

* If the ordinary brown citrate be used, the formula should contain 80 grs. (188 grms.). and the ferricyanide should be increased to 60 grs. (137 grms.).

For sepia tones.

Rochelle salt	.. .. .	1 oz.	50 gms.
Water	.. .. .	20 ozs.	1000 c.c.s.
Potass bichromate sol. (1 %)	.. .. .	8-10 drs.	50 60 c.c.s.

For black tones

Sodium acetate	.. .. .	3 ozs.	150 gms
Water	.. .. .	20 ozs.	1000 c.c.s.

From this developer prints must be passed into a bath of potass oxalate (15 %) before fixing.

FIXING SOLUTION.

Hypo	.. .. .	1 oz.	200 gms.
Ammonia (0 880)	.. .. .	120 minims	12 c.c.s.
Water	.. .. .	20 ozs.	1000 c.c.s.

Sepia Paper.

A Ferric ammonia citrate (green)	.. .. .	110 grs.	250 gms.
Water	.. .. .	1 oz.	1000 c.c.s.
B Tartaric acid	.. .. .	18 grs.	40 gms.
Water	.. .. .	1 oz.	1000 c.c.s.
C Silver nitrate	.. .. .	45 grs.	100 gms.
Water	.. .. .	1 oz.	1000 c.c.s.
D. Gelatine	.. .. .	30 grs.	70 gms.
Water	.. .. .	1 oz.	1000 c.c.s.

Equal parts (say 1 oz. of each) of these solutions are mixed as follows:—D is rendered just fluid on a water bath, A and B added, and lastly C, a few drops at a time. The prints are fixed in 1: 50 hypo

One-Solution Sepia Sensitiser.

Silver nitrate	.. .. .	55 grs.	3.5 gms.
Water	.. .. .	4.5 drachms	15.20 c.c.s.

Add ammonia drop by drop to just redissolve the white precipitate, and then a little sulphuric (or citric) acid to just remove the odour of ammonia. Then add—

Ferric ammonium citrate (green)	40 grs.	2.5 gms.
Water	6 drachms	25 c.c.s.

This solution keeps in the dark, and is used like the four-solution mixture.

Pellet Process.

A. Pure gum arabic	.. .. .	4 ozs.	200 gms.
Water	.. .. .	20 ozs.	1000 c.c.s.
B. Ferric ammonium citrate	.. .. .	10 ozs.	500 gms.
Water	.. .. .	20 ozs.	1000 c.c.s.
C. Ferric chloride (crystallised)	.. .. .	10 ozs.	500 gms.
Water	.. .. .	20 ozs.	1000 c.c.s.

Add 8 vols. of B, then 5 vols. of C to 20 vols. of A, in small doses with constant stirring.

The prints are developed on 10 per cent. solution of potass ferrocyanide and "fixed" in 1: 25 sulphuric acid (specific gravity 1.98).

The Ferro-Gallic Process.

Gum arabic	..	..	..	60 grs.	135 gms.
Warm water	..	..	..	1 oz.	1000 c.c.s.

When dissolved add the following in the order given:—

Tartaric acid	..	..	..	8 grs.	18 gms.
Salt ..	..	..	..	36 grs.	81 gms.
Ferric sulphate	..	..	..	40 grs.	90 gms.
Ferric chloride	..	..	..	60 grs.	135 gms.

The developer for the prints is:—Alum and gallic acid, 1 part of each; water, 80 parts.

MOUNTANTS.

Starch Paste.

Pure starch is mixed with a very small proportion of cold water to form a very stiff mass. It should be so stiff that it is stirred with difficulty. Perfectly boiling water is then poured in, about 12 ozs. for every ounce of starch. On stirring the mixture will jellyify without being boiled; but if it does not it is brought to the boil, cooled, the skin taken off, and the paste used on day of making.

Gelatine.

For mounting prints without cockling.

Nelson's No. 1 gelatine	..	..	4 ozs.	50 gms.
Water	..	..	16 ozs.	200 c.c.s.

Soften the gelatine in the water, liquefy on the water bath, and add a little at a time and stirring rapidly:—

Methylated spirit	..	..	5 ozs.	30 c.c.s.
Glycerine	..	..	1 oz.	6 c.c.s.

The mountant is used hot. A piece of ground glass is dipped in hot water, drained, and the mountant brushed over. The print is then laid face up on the pasted surface and rubbed gently in contact with a piece of paper, being then removed and pressed down on its mount.

Dextrine Paste.

Best white dextrine	..	..	1 lb.	
Cold water	..	..	..	to make stiff paste
Water	..	..	10 ozs.	
Oil of wintergreen	..	..	1 drachm	

Mix the dextrine and water together in small doses of each, so as to ensure a mixture free from lumps and clots. Dilute with the further quantity of water, add the oil, and just bring the whole mixture to th

boil, when it should be like clear gum. Pour into pots, cover up, and in from 12 to 24 hours it will be set to a hard and white paste of great adhesive power. The dextrine must be the best white; inferior dextrine remains treacly on cooling,

Starch-Gelatine.

A. Bermuda arrowroot	.. ..	8 ozs	200 gms.
Water	.. ..	4 ozs.	100 c.c.s.
B Nelson's No. 1 soft gelatine	.. ..	360 grs.	10 gms.
Water	.. ..	64 ozs.	800 c.c.s.

The gelatine is first softened in the water and A and B are then mixed together and boiled for a few minutes. To the cold mixture are stirred in—

Methylated spirit	.. ..	5 ozs.	250 c.c.s.
Carbolic acid (liquid)	.. ..	25 minims	3 c.c.s.

This is a good cold paste, which sticks and keeps fairly well.

Liquid Gelatine.

Gelatine	.. ..	1 oz.	100 gms.
Water	.. ..	6 ozs.	600 c.c.s.
Chloral hydrate	.. ..	1 oz.	100 gms.

The gelatine is dissolved in the water by aid of heat, and the chloral hydrate added. After digesting for a short time the adhesive liquid is neutralised with a little sodium carbonate solution.

Gum-Dextrine.

Picked white gum arabic	.. ..	$\frac{1}{2}$ oz.	65 gms.
Dextrine	.. ..	2 $\frac{1}{2}$ ozs.	280 gms.
Liquid ammonia	.. ..	4 drops	50 c.c.s.
Carbolic acid	.. ..	1 drachm	15 c.c.s.
Water	.. ..	8 ozs.	1000 c.c.s.

The gum is powdered in a mortar and mixed intimately with the dextrine, and rubbed with 2 ozs. of water until a smooth mixture is obtained. The remainder of the water is added, and the whole boiled for 10 minutes. The ammonia and carbolic acid are added when cold. This mountant keeps well for months, and is smooth in working and of great adhesiveness.

Shellac Mountant.

A strong solution of shellac in methylated spirit, or, better, rectified spirit, is thinly applied to both mount and print, and the two coated surfaces quickly rubbed into contact. A good method of fixing prints to thin mounts in albums, etc.

Affixing Paper to Metal.

Tragacanth	..	..	3 ozs.	60 gms.
Gum arabic	..	..	12 ozs.	240 gms.
Water	..	..	50 ozs.	1000 c.c.s.
or—				
Gum arabic	..	..	1 oz	100 gms.
Aluminium sulphate	..	..	45 grs.	10 gms.
Water	..	..	10 ozs.	1000 c.c.s.

Mounting on Glass (Opalines).

Nelson's No. 2 soft gelatine	..	2 ozs.	30 gms.
Water	..	20 ozs.	300 c.c.s.

The gelatine is soaked in the water, and liquefied by standing the vessel in hot water. The solution is thinned down until nearly as thin as water. Print and glass are immersed, removed together, and squeezed together with flat rubber squeegee.

WORKING UP, COLOURING, ETC., PRINTS.

Lubricant for Burnishing Prints.

* Powdered Castile soap	..	20 grs.	5 gms.
Alcohol	..	10 ozs.	1000 c.c.s.

Encaustic Paste.

Purified beeswax	..	..	..	50 parts
Oil of lavender..	..	..	..	30 parts
Benzol ..	..	..	..	30 parts
Gum elemi	..	..	..	1 part

BASKETT'S FORMULA.

To the contents of a 2d. tin of Globe polish add 1 oz. best olive oil and 1 oz. terebine. Apply with soft cloth and polish.

Preparing Prints for Colouring.

P.O.P.'S AND GLOSSY BROMIDES.

Rub the prints lightly with a tuft of wool slightly moistened with artist's purified ox-gall. If they have been lubricated before burnishing apply previously a little alcohol in the same way.

COLLODION PRINTS.

Fluid extract of quillaia ..	1 drachm	5 c.c.s.
Water	1 oz.	40 c.c.s.
Alcohol	1 oz.	40 c.c.s.

BROMIDES.

For Water Colouring.

Apply ox-gall as directed for P.O.P., or prepare as directed below for pastel work.

For Oil Colouring.

If the surface is clean no preparation is needed ; if otherwise give a wash of gum, starch, or gelatine, or prepare with pumice powder. Also light drying oil (from the artists' colourman) may be rubbed over with a tuft of wool or the fingers. It dries in about twenty-four hours, and leaves the surface of the bromide ready for painting.

For working up in pastel or black and white, apply fine pumice powder with a tuft of wool, and *remove* with another piece of wool or a duster.

Fixatif for Crayon and Pastel Work.

A. Mastic	24 grs.	1·6 gm.
Amyl acetate	3 ozs.	85 c.c.s.

Dissolve by agitation, and allow to stand some hours before use.

B. Celluloid (film clippings free from emulsion will do) ..	7 grs.	0·45 gm.
Amyl acetate	3 ozs.	85 c.c.s.

Dissolve by agitation. Mix when both are clear, and keep in tightly-corked bottle. Apply with spray diffuser.

Colouring Prints with Dyes.

Dissolve the aniline colour (1d. packets of dye will do) in a sufficient quantity of water (from $\frac{1}{2}$ to 1 oz. to a 1d. packet), and for glossy prints add a little gum. If the work affects the gloss when finished, rub the print over with a piece of wool slightly moistened with a solution of wax in benzole.

Colouring Prints with Artists' Water Colours.

The following are suitable colours : those in italics are transparent, the others are semi-transparent, and all are practically permanent. They are mentioned in the order of their usefulness, viz. :—

Alizarin Crimson.

Alizarin Yellow.

Cobalt Blue.

Bistre.

Madder Brown.

Alizarin Green.

Payne's Grey.

Prussian Blue.

Aureolin.

Olive Green.

Raw Sienna.

Burnt Sienna.

Burnt Carmine (Purple Lake).

Purple Madder.

Viridian Green.

Sap Green.

Sepia.

The following are also useful, but either cannot be classed as permanent colours (marked +) or are not transparent (marked *):—Carminet; Light Red*, Pink, Rose, and Rose Doré Madders†; Scarlet Lake*, Ultramarine or French Ultramarine*, Indigo†, Brown Pink†, Burnt Umber*, Vandyke Brown*, Gamboge†, Naples Yellow*, Yellow Ochre*, Roman Ochre*.

N.B.—The quality and names of the different makers vary. The foregoing lists refer to those colours manufactured by Messrs. Reeves and Sons, Ltd., and of "Artists' Quality."

Spotting Bromide Prints.

Mix together Payne's grey and Indian ink (the colour should match that of the film)

Spotting P.O.P. Prints.

Add a little carmine to the above. When mixtures dry (on the palette) work in a strong solution of gum, rubbing the brush one way only, to avoid making air-bells. If the prints are to be enamelled or glazed by stripping after spotting, then artists' oil colours with benzole in which gum dammar has been dissolved, or water colours, may be used with shellac water varnish. (See "Negative Varnishes.")

Colouring from Behind (Crystoleum).

The print (which should be albumen) is mounted with a warm solution of:—

Hard gelatine	.. .. .	20 grs.	45 gms.
Water	.. .. .	1 oz.	1000 c.c.s.

containing a little salicylic acid to keep it. Or with a cold mountant made by mixing the above with an equal volume of starch paste.

VARNISH FOR "TRANSLUCING."

Canada balsam	.. .. .	5 ozs.	100 gms.
Solid paraffin	.. .. .	2 ozs.	40 gms.
White wax	.. .. .	2 ozs.	40 gms.

which is melted, the picture immersed, and the whole kept as cool as possible consistent with remaining fluid.

MISCELLANEOUS FORMULÆ.

Reversed Negatives by Ammonium Persulphate.

A lantern or other thinly coated slow plate is placed in contact with the negative in a printing frame and a full exposure given such as would be thought advisable in making a soft positive transparency. The plate is developed with a clean working developer (*e.g.*, glycin)

until the shadows appear quite black on the glass side of the plate. The time of development may be five times as long as for an ordinary transparency. The latter is then washed and placed in a 2 per cent solution of ammonium persulphate until the silver image is seen to be removed. The plate is then thoroughly washed and developed in any clean developer containing about half a grain of bromide per ounce. It is then fixed and washed and dried. After the first development the operations may be done in weak daylight or artificial light. The action of the persulphate should be as complete as possible, otherwise a veil is left over the negative. The above is a very rapid and economical process. Direct positives, but reversed from right to left, from engravings, etc., may be made in the camera by substituting bromide paper for the plate. The exposure should be full and the development as above. The method has this advantage, that the lines are rendered in the same degrees of black and grey as in the original, a point of some importance since the lines in an engraving are seldom, if ever, of uniform blackness.

To Recover Fogged Plates.

Potass bichromate ..	100 to 200 grs	11 to 22 gms.
Hydrochloric acid	30 minims	3 5 c.c.s.
Water ..	20 ozs.	1000 c.c.s.

Bathe plates in above for two minutes, wash for one or two minutes in running water, and dry. Solution slows plates, and may be used, as above or after exposure, to obtain contrast on extra-rapid plates—*e.g.*, when copying black and white or other subjects.

Backing Dry Plates.

Gum solution (ordinary office gum) ..	1 oz	100 c.c.s.
Caramel ..	1 oz	100 gms.
Burnt sienna, ground in water ..	2 ozs.	200 gms.
Mix and add—		
Alcohol ..	2 ozs. (fl.)	200 c.c.s.

BACKING SHEETS FOR DRY PLATES.

Gelatine ..	1 part	50 gms.
Water ..	2 parts	100 c.c.s.
Glycerine ..	1 part	50 c.c.s.
Indian ink ..	A small addition.	

Make a paste, and coat strong paper; place the prepared material, face downwards, on waxed glass to set. Press to back of plate before putting into dark slide.

The Dusting-on Process.

Best gum arabic ..	80 grs.	5.2 gms.
White sugar ..	60 grs.	4.0 gms.
Ammonium bichromate ..	60 grs.	4.0 gms.
Water ..	7 ozs.	200 c.c.s.
Methylated spirit ..	1 oz.	30 c.c.s.

This mixture will keep for a few days only, and after the plate has been coated and exposed it is developed with finest graphite powder collodionised, and washed.

Ink for Rubber Stamps.

Aniline red (violet)	900 grs.	210 gms.
Boiling distilled water	10 ozs.	1000 c.c.s.
Glycerine about	$\frac{1}{2}$ oz.	60 c.c.s.
Treacle about	$\frac{1}{2}$ oz.	30 c.c.s.

Invisible Ink.

Chloride of cobalt	25 grs.	60 gms.
Distilled water	1 oz. (fl.)	1000 c.c.s.

Writing executed with this ink is first pink on paper, becoming invisible on drying. On warming the writing turns blue.

Dead Black for Wood.

Borax	30 grs.	8 gms.
Glycerine	30 minims	8 c.c.s.
Shellac	60 grs.	16 gms.
Water	8 ozs.	1000 c.c.s.
Boil till dissolved and add—		
Nigrosine W.S.	60 grs.	16 gms.
Or paint the wood first with		
Cupric chloride	75 grs.	75 gms.
Potassium bichromate	75 grs.	75 gms.
Water	2 $\frac{1}{2}$ ozs.	1000 c.c.s.

and as soon as the surface dries apply

Aniline hydrochlorate	150 grs.	150 gms.
Water	2 $\frac{1}{2}$ ozs.	1000 c.c.s.

and wipe off any yellow powder that forms. Repeat the process till black enough, and then rub over with boiled linseed oil.

Waterproofing Solution for Wood.

Asphalt	4 ozs.	400 gms.
Pure rubber	30 grs.	6 gms.
Mineral naphtha	10 ozs.	1000 c.c.s.

Apply with a stiff brush and give three successive coats, allowing to dry between each. The vapour from this solution is very inflammable.

Polish for Cameras, Woodwork, etc.

Linseed oil	20 ozs.	400 c.c.s.
Spirits of camphor	2 ozs.	40 c.c.s.
Vinegar	4 ozs.	80 c.c.s.
Butter of antimony	1 oz.	20 gms.
Liquid ammonia	$\frac{1}{2}$ oz.	5 c.c.s.
Water	$\frac{1}{2}$ oz.	5 c.c.s.

This mixture is applied very sparingly with a bit of old flannel, and thoroughly rubbed off with soft rags.

Blackening Brass Work.

A	Copper nitrate	.. .. .	200 grs.	450 gms.
	Water	.. .. .	1 c z.	1000 c.c.s.
B	Silver nitrate	.. .. .	200 grs.	450 gms.
	Water	.. .. .	1 oz.	1000 c.c.s.

Mix A and B, and place the brass work (perfectly cleaned) in the solution for a few moments, heating it on removal

Varnish for Brass Work.

Celluloid	.. . . .	10 grs.	4 gms.
Amyl alcohol	.. .. .	$\frac{1}{2}$ oz.	100 c.c.s.
Acetone	.. .. .	$\frac{1}{2}$ oz.	100 c.c.s.

Instead of this cold celluloid varnish, commercial "cold lacquer" can be used.

To Blacken Aluminium.

Clean the metal thoroughly with fine emery powder, wash well, and immerse in --

Ferrous sulphate	.. .. .	1 oz	80 gms.
White arsenic	1 oz.	80 gms.
Hydrochloric acid	12 ozs.	1000 c.c.s.

Dissolve and add--

Water	12 ozs.	1000 c.c.s.
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When the colour is deep enough dry off with fine sawdust, and lacquer.

Silvering Mirrors (Martin's Method).

(In employing the following formula, it should be well understood that the glass plate to be silvered must be scrupulously clean)

A.	Nitrate of silver	.. .. .	175 grs	40 gms
	Distilled water	.. .. .	10 ozs.	1000 c.c.s.
B.	Nitrate of ammonium	.. .. .	262 grs.	60 gms.
	Distilled water	.. .. .	10 ozs.	1000 c.c.s.
C	Pure caustic potash	.. .. .	1 oz.	100 gms.
	Distilled water	.. .. .	10 ozs.	1000 c.c.s.
D.	Pure sugar candy	.. .. .	$\frac{1}{2}$ oz. (avoir)	100 gms
	Distilled water	5 ozs.	1000 c.c.s.

Dissolve and add--

Tartaric acid	50 grs.	23 gms.
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Boil in flask for ten minutes, and when cool add--

Alcohol	1 oz.	200 c.c.s.
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Distilled water, *quant. suff*, to make up to 10 ozs. or 2000 c.c.s.

For use, take equal parts of A and B. Mix together also equal parts of C and D, and mix in another measure. Then mix both these mixtures together in the silvering vessel, and suspend the mirror face downward in the solution.

DEVELOPING FORMULÆ, ETC., OF THE PRINCIPAL PLATE AND PAPER MAKERS.

In all cases, except where otherwise specified, crystallised sodium sulphate and carbonate are to be used.

AUSTIN EDWARDS, LTD.

"Ensign" Flat and Roll-Films.

PYRO DEVELOPER

A. Pyro	1 oz.	12.5 gms.
Nitric acid	20 drops	10 drops.
Or—		
Potass metabisulphite	100 grs.	2.3 gms.
Water	80 ozs.	1000 c.c.s.
B. Soda carbonate crystal	9 ozs.	112.5 gms.
Soda sulphite	10 ozs.	125 gms.
Potass bromide	80 grs.	2.3 gms.
Water	80 ozs.	1000 c.c.s.

For use, take A, 1 part; B, 1 part

• "Rodinal" gives excellent results with the films. When using "Rodinal" for normal exposures and dark room development it should be diluted with 15 parts water; development will then be complete in about 6 minutes. For tank development 1 part "Rodinal" may be diluted with 30 to 45 parts of water and development will then take from 20 to 30 minutes.

BAYER CO., LTD.

"Pan" Paper.

Water	10 ozs.	1000 c.c.s.
Sodium sulphite (cryst.)	1½ oz.	125 gms.
Hydroquinone	72 grs.	16 gms.
Sodium carbonate (cryst.)	2½ grs.	250 gms.
Potass bromide	48 grs.	11 gms.

"Tula" and "St. Luke's" Papers.

Potass metabisulphite	48 grs.	1 gm.
Edinol crystals	24 grs	$\frac{1}{2}$ gm.
Potass carbonate (cryst.) ..	144 grs.	3 gms.
Water	10 ozs.	100 c.c.s.
Potass bromide, 10 % solution ..	6 drops	2 drops

The above developer, when freshly made, gives blue-black tones ;
when standing for some time, brown-black tones

Bayer Bromide Paper.

A. Edinol crystals	1 oz.	10 gms.
Acetone sulphite crystals ..	5 ozs.	50 gms.
Or -		
Sodium sulphite	10 ozs	100 gms.
Water	100 ozs.	1000 c.c.s.
B. Potass carbonate crystals ..	25 ozs.	250 gms.
Water	50 ozs.	500 c.c.s.

For use, take 4 ozs. A, 1 oz B, and 5 ozs. water, adding 5 drops of
potassium bromide solution 10 per cent.

BIRMINGHAM PHOTOGRAPHIC CO., LTD.**"Criterion" P.O.P.****TONING BATHS**

Ammonium sulphocyanide ..	15 grs.	1.7 gm.
Gold chloride	$1\frac{1}{2}$ gr.	0.17 gm.
Water	20 ozs.	1000 c.c.s.

For Light Red Tones.

Ammonium sulphocyanide ..	10 grs.	1.1 gm.
Sodium sulphite	1 gr.	0.11 gm.
Gold chloride	1 gr.	0.11 gm.
Water	20 ozs.	1000 c.c.s.

Estona (Self-Toning) Paper.

Fix, without previous washing, for 8 to 10 minutes in :—

Hypo, 2 ozs. per pint for reddish-brown tones.

Hypo, 4 ozs. per pint for warm purple tones.

Hypo, 6 ozs. per pint for deep purple tones.

"Criterion" Bromide Paper.

Amidol	75 grs.	8.5 gms.
Sodium sulphite	650 grs.	74 gms
Potass bromide	4 grs.	0.4 gm.
Water	20 ozs.	1000 c.c.s.

"Celerio" (Gaslight) Paper.

For Contrasty Effects.

Potass metabisulphite .. .	20 grs	2 3 gms.
Metol .. .	14 grs	1 6 gm
Hydroquinone .. .	60 grs	6 8 gms
Sodium sulphite .. .	$\frac{1}{4}$ oz	12 5 gms.
Sodium carbonate .. .	800 grs.	91 gms.
Potass bromide, 10 % solution ..	20 drops	30 drops
Water .. .	20 ozs.	1000 c.c. s.

For Soft Effects.

Metol .. .	50 grs.	5 7 gms.
Sodium sulphite .. .	320 grs	36 5 gms.
Sodium carbonate .. .	640 grs.	73 0 gms.
Potass bromide, 10 % solution ..	20 minims	1 8 c.c.
Water .. .	20 ozs	1000 c.c.s.

CADETT & NEALL, LTD.

"Royal Standard" Plates.

Rapid," "Extra Rapid," "Special Extra Rapid," and "Ortho."

PYRO-SODA.

A. Pyro.. .. .	1 oz.	25 gms.
Sodium sulphite (cryst.) .. .	8 oz.	200 gms.
Potass metabisulphite .. .	60 grs.	3 gms.
Potass bromide .. .	60 grs.	3 gms
Water (distilled or boiled) ..	to 80 ozs.	2000 c.c.s.
B. Sodium carbonate (cryst.) ..	8 oz.	200 gms.
Water (distilled or boiled) ..	to 80 ozs.	2000 c.c.s.

Use equal parts of A and B.

Add more A for over-exposure; more of B for under-exposure.

For softer negatives use developer diluted with equal bulk of water.

PYRO-METOL.

Highly recommended for short exposures and for rapid development. With normal exposure and with temperature of about 65° F development takes place in about 2½-3 minutes.

A. Pyro .. .	110 grs.	7 5 gms.
Metol .. .	110 grs.	7 5 gms.
Potass metabisulphite .. .	220 grs.	15 gms.
Water (distilled or boiled) ..	35 ozs.	1000 c.c.s.
B. Sodium carbonate (cryst.) ..	9 ozs.	250 gms.
Sodium sulphite (cryst.) ..	2½ ozs.	63 gms.
Water (distilled or boiled) ..	35 ozs.	1000 c.c.s.

For use take A, 1 part; B, 1 part; water, 1 part.

"Royal Standard" P.O.P.*Toning Bath for Cold Tones*

A. Gold chloride	15 grs.	1 gm.
Water	15 drachms	54 c.c.s.
B. Ammonium sulphocyanide	1 oz.	45.5 gm ^s .
Water	22 ozs.	1000 c.c.s.

Water, 20 ozs.; A, 1 oz.; B, 2 drachms.

For Warm Tones

A. Gold chloride	15 grs.	1 gm.
Water	15 ozs.	425 c.c.s.
B. Borax	300 grs.	23 gms.
Water	30 ozs.	1000 c.c.s.

A, 1 oz., B, 2 ozs., water to 40 ozs.

"Cadett" Bromide Papers.

METOL-HYDROQUINONE.

For very Brilliant Prints

A. Metol	100 grs.	6 gms.
Hydroquinone	50 grs.	3 gms.
Sodium sulphite	2 ozs. avd.	20 gms.
Water to make	40 ozs. (fl.)	1000 c.c.s.
B. Sodium carb. (cryst.) washing soda, select translucent pieces	1 oz. avd.	25 gms.
Potass bromide	60 grs.	3 gms.
Water to make	40 ozs. (fl.)	1000 c.c.s.

Equal parts of A and B to make developer

"Royal Standard" Lantern Plates.*Black Tone.*

METOL DEVELOPER.

A. Metol	200 grs.	15 gms.
Sodium sulphite (cryst.)	2 ozs.	60 gms.
Potassium bromide	25 grs.	2 gms.
Water	20 ozs.	600 c.c.s.
B. Washing soda	5 ozs.	150 gms.
Water	20 ozs.	600 c.c.s.

This developer works rather slowly, about 2½ to 3 minutes giving brilliant slides

PYRO-AMMONIA.

P. Pyro	1 oz.	100 gms.
Potass metabisulphite	¾ oz.	75 gms.
Water (distilled or boiled) to make	10 ozs.	1000 c.c.s.

A. Ammonia '880	.. .. .	1 oz.	100 c c.s.
Water (distilled or boiled) to make	10 ozs.		1000 c.c.s.
B. Ammonium bromide	.. .. .	1 oz.	100 gms.
Water (distilled or boiled) to make	10 ozs.		1000 c c.s.

For use take

P.	$\frac{1}{2}$ oz.	15 c.c.s.
A.	$\frac{3}{4}$ oz.	20 c.c.s.
B.	60 mins.	4 c.c.s.
Water	6 ozs.	200 c c.s.

“ CHALLENGE ” WORKS.**“ Challenge ” P.O.P.***Toning Solutions.*

A. Ammonium sulphocyanide	... 150 grs.	23 gms.
Water	... 15 ozs.	1000 c.c.s.
B Gold chloride	.. .. 15 grs.	23 gms.
Water	.. .. 15 ozs.	1000 c c.s.

A, 2 ozs., B, added last, 2 ozs., water to make 20 ozs.

Self-Toning ‘ Challenge ’ P.O.P.*Firing Bath.*

Hypo	... .. 3 ozs.	150 gms.
Water	... .. 20 ozs.	1000 c c.s.

This is used for six minutes. It is made of double strength when purple tones are desired.

“ Challenge ” Bromide Papers.*Developer.*

Amidol	... .. 50 grs.	5.7 gms.
Sodium sulphite	... .. 650 grs.	74 gms.
Potass. bromide	.. .. 10 grs.	1.14 gms.
Water	... .. 20 ozs.	1000 c.c.s.

To be used within three days of making.

“ Challenge ” Gaslight Paper.*Developer.*

Metol	... .. 6 grs.	1.4 gms.
Sodium sulphite	... .. $\frac{1}{2}$ oz.	50 gms.
Hydroquinone	... .. 30 grs.	6.8 gms.
Sodium carbonate (cryst.)	... 1 oz.	100 gms.
Potass. bromide, 10 per cent. solution	... .. 30 drops	100 drops
Water	... .. 10 ozs.	1000 c.c.s.

ELLIOTT AND SONS, LTD.

"Barnet," "Red Seal," "Studio," "Ortho," and "Medium Ortho" Plates.

Pyro Stock Solution, A

Potass. metabisulphite	100 grs.	6.5 gms.
Pyro	1 oz.	28 gms.
Potass. bromide	60 grs.	3.9 gms.
Water	8 ozs.	225 c.c.s.

Developer.

No. 1. Solution A.	2 ozs.	50 c.c.s.
Water	18 ozs.	450 c.c.s.
No. 2. Sodium carbonate	2 ozs.	100 gms.
Sodium sulphite	2½ ozs.	112.5 gms.
Water	20 ozs.	1000 c.c.s.

For use, take equal parts of Nos. 1 and 2. For soft negatives or portraiture, take No. 1, 1 part; No. 2, 2 parts; water, 1 part.

"Barnet," "Rocket," "Extra Rapid" and "Ordinary" Plates, and Barnet Roll Film.

A Pyro	1 oz.	12 gms.
Potass. bromide	60 grs.	2 gms.
Nitric acid	20 drops	.5 c.c.s.
Water	80 ozs.	1000 c.c.s.
B. Sodium sulphite	9 ozs.	112 gms.
Sodium carbonate	8 ozs.	100 gms.
Water	80 ozs.	1000 c.c.s.

For ordinary use, equal parts of Nos 1 and 2. For under-exposure add more of No. 2 or dilute the developer with water. For over-exposure add more of No 1 or a few drops of 10 per cent. solution of potassium bromide

Barnet Matt. P.O.P.

Toning Baths

A Ammonium sulphocyanide ..	80 grs.	2.3 gms.
Water	80 ozs.	1000 c.c.s.
B. Gold chloride	15 grs.	1 gm.
Water	15 drs.	60 c.c.s.
C. (To be made up fresh every day)		
Sulphite soda	15 grs.	1 gm.
Water	15 drs.	60 c.c.s.

For use, take 16 ozs A, 2 drachms B, and 2 drachms C.

A good rich brown tone takes about 3 minutes, but for colder tones toning should be carried further. Judge the tone by looking on the surface of the prints.

Another good bath is—

Sodium phosphate	60 grs.	3.4 gms.
Gold chloride	2 grs.	11 gm.
Water	40 ozs.	1000 c.c.s.

Keep this bath for an hour before use, and throw it away as soon as the prints are toned, as it will not keep long.

For Barnet "Ordinary" P.O.P., the A sulphocyanide solution given on opposite page is mixed with gold (16 ozs. with 2 grs. gold or 350 c.c.s. with 0.1 gm.) to form the toning bath.

Barnet "Kiplo" (Self-toning) Paper.

Place direct for 8 to 15 minutes in hypo, 1 oz.; water, 5 ozs.; or use a 1 : 20 salt bath for five minutes previous to above

Barnet Bromide Papers.

Metol Developer.

A. Metol	.. .. .	400 grs.	11 gms.
Sodium sulphite	.. .. .	8 ozs.	100 gms.
Potass. bromide	.. .. .	50 grs.	1.5 gm.
Water	.. .. .	80 ozs.	1000 c.c.s.
B. Potass. carbonate	.. .. .	8 ozs.	100 gms.
Water	.. .. .	80 ozs.	1000 c.c.s.

Take 3 ozs. of A and 1 oz. of B.

The image should appear in a few seconds, and development will be complete in about $1\frac{1}{2}$ minutes. Rinse in three changes of water and fix.

Metol-Hydroquinone

Metol	.. .. .	200 grs.	6 gms.
Sodium sulphite	.. .. .	6 ozs.	75 gms.
• Hydroquinone	.. .. .	150 grs.	4 gms.
Potass. carbonate	.. .. .	2 ozs.	25 gms.
Potass. bromide	.. .. .	50 grs.	1.5 gm.
• Water	.. .. .	80 ozs.	1000 c.c.s.

Development will be complete in from 1 to 2 minutes.

For softer prints, either of the above may be diluted with an equal bulk of water just before use.

Barnet "Oyster-Shell" (Gaslight) Paper.

Metol	.. .. .	8 grs.	1.75 gms.
Hydroquinone	.. .. .	30 grs.	7.0 gms.
Sodium sulphite	.. .. .	350 grs.	75.0 gms.
Sodium carbonate	.. .. .	300 grs.	70.0 gms.
Potass. bromide	.. .. .	3 grs.	.7 gm.
Water	.. .. .	10 ozs.	1000 c.c.s.

The ingredients should be dissolved in the order named. If softer results are required the developer should be diluted with an equal bulk of water, and a somewhat longer exposure be given.

Barnet Lantern Plates.

For Warm Black Tones.

A. Hydroquinone	..	..	160 grs.	18 gms.
Sodium sulphite	..	..	2 ozs.	100 gms.
Potass bromide	..	..	30 grs.	3 gms.
Citric acid	..	..	60 grs.	7 gms.
Water	..	..	20 ozs.	1000 c.c.s.
B. Sodium hydrate	..	..	160 grs.	18 gms.
Water	..	..	20 ozs.	1000 c.c.s.

Take equal parts of A and B.

This produces a very pleasing warm black. Length of time in developing about 2 minutes.

For Warm Brown Tones.

A. Pyro	..	..	1 oz.	12 5 gms.
Soda sulphite	..	..	1 oz.	50 gms.
Water	..	..	20 ozs.	1000 c.c.s.
B. Carbonate of ammonia	..	..	225 grs.	26 gms.
Potassium hydrate	..	..	190 grs.	21 gms.
Ammonium bromide	..	..	150 grs.	17 gms.
Water	..	..	20 ozs.	1000 c.c.s.

Take equal parts of A and B.

Length of time in developing about 2 minutes.

Or the following may be used —

Take equal parts of hydroquinone formula and add to each ounce (100 c.c.s.) 3 grs. (6 gms.) each of carbonate of ammonia and ammonium bromide.

Length of time in developing about 3 or 4 minutes.

For very Warm (Reddish) Tones.

Take equal parts of hydroquinone formula and add to each ounce (100 c.c.s.) 6 grs. (1.2 gm.) each of carbonate of ammonia and ammonium bromide.

Length of time in developing about eight minutes.

Barnet (Gaslight) Lantern Plates.

For Black and Warm Black Tones.

Hydroquinone	..	..	60 grs.	6.8 gms.
Sodium sulphite	..	..	1 oz.	50 gms.
Potass carbonate	..	..	2 ozs.	100 gms.
Potass bromide	..	..	20 grs.	2.3 gms.
Water	..	..	20 ozs.	1000 c.c.

This solution should develop in about two minutes.

For Cold Black Tones.

Rodinal	..	..	..	1½ ozs. (fl)	62 5 c.c.s.
Potass bromide	..	..	..	15 grs.	1.7 gms.
Water	20 ozs.	1000 c.c.s.

For Warm Tones.

Eikonogen..	..	..	..	30 grs.	3.4 gms.
Hydroquinone	..	..	..	10 grs.	1.2 gms.
Sodium sulphite	..	..	..	160 grs.	18.2 gms.
Potass carbonate	..	..	..	80 grs.	9.1 gms.
Potass bromide	..	..	..	15 grs.	1.7 gms.
Citric acid	..	..	..	20 grs.	2.3 gms.
Water	..	..	..	20 ozs.	1,000 c.c.s.

GEM DRY PLATE COMPANY, LTD.*Developer for Plates and Papers.*

Potass. metabisulphite	..	..	40 grs.	4 gms.
Metol	..	..	28 grs.	2.8 gms.
Hydroquinone	..	..	120 grs.	12 gms.
Sodium sulphite	..	..	2 ozs.	96 gms.
Sodium carbonate	..	..	3½ ozs.	168 gms.
Water	..	..	40 ozs.	1,800 c.c.s.

Add and dissolve in order named. To each ounce (28 cc.) of developer add 2 drops of a 10 per cent. solution of potass. bromide. Use full strength for gaslight paper. Dilute with an equal volume of water for bromide paper and plates.

"Gem" P.O.P.

A. Ammonium sulphocyanide	..	30 grs.	2 gms.
Water	..	10 ozs.	284 c.c.s.
B. Gold chloride	..	2 grs.	0.13 gm.
Water	..	10 ozs.	284 c.c.s.

Into a portion of A pour slowly an equal portion of B.

"Gem" Lantern Plates.*Developer for Cold Tones*

A. Hydroquinone	..	120 grs.	8 gms.
Potass. bromide	..	180 grs.	12 gms.
Potass. metabisulphite	..	120 grs.	8 gms.
Water	..	30 ozs.	900 c.c.s.
B. Caustic potash (sticks)	..	240 grs.	16 gms.
Water	..	30 ozs.	900 c.c.s.

Use equal parts of A and B.

For chloride plates, dilute with water 4 to 8 times.

For Warm Tones.

C. Ammonium carbonate	1 oz.	10 gms.
Ammonium bromide	1 oz.	10 gms.
Water	20 ozs.	200 c.c.s.

To obtain extra warm tones on "Gem" red lantern plates, give over exposure and develop with one part of solution A and B and one part of C, increasing C as the exposure is lengthened.

JOHN J. GRIFFIN & SONS, LTD.

Velox Papers.*Developer.*

(Dissolve chemicals in the order named)

Metol	14 grs.	1.6 gm.
Hydroquinone	60 grs.	6.8 gms.
Sodium sulphite (desiccated) ..	220 grs.	25.3 gms.
Sodium carbonate (desiccated) ..	300 grs.	34.2 gms.
10 per cent. solution potassium bromide	80 drops	7 c.c.s.
Water	20 ozs	1000 c.c.s.

This solution will keep indefinitely if placed in bottles filled to the neck and tightly corked. It should be used full strength for "Regular," but can be diluted with equal parts of water when Special Velox is developed.

"Snow-White" Bromide Paper.

To develop the image, first plunge the paper in clean water, place at the bottom of a clean porcelain dish, and apply evenly the following or any standard developer.—

Amidol	70 grs.	8 gms.
Sodium sulphite	650 grs.	74 gms.
Potassium bromide	4 grs.	.45 gm.
Water	20 ozs.	1000 c.c.s.

Carbona P.O.P.*TONING.*

Gold chloride	2 grs.	.23 gm
Ammonium sulphocyanide ..	20 grs.	2.3 gms.
Water	20 ozs.	1000 c.c.s.

COMBINED BATH.

Distilled water	.. ..	35 ozs.	2000 c.c.s.
Hypo	.. ..	4½ ozs.	250 gms.
Alum	.. ..	¾ oz.	43 gms.
Ammonium sulphocyanide	.. ..	150 grs.	20 gms.
Sodium chloride	.. ..	1½ oz.	86 gms.

After a short time the liquid gets thick. It must then be left for eight days, and the clear liquid finally poured off. Then add to the clear solution—

Gold chloride	.. ..	15 grs.	1 gm.
Water	.. ..	3½ ozs.	100 c.c.s.

PLATINUM TONING BATH.

1% potass. chloroplatinite solution	5½ drachms	20 c.c.s.
Citric acid	.. ..	80 grs.
Water up to	.. ..	10 ozs.
		280 c.c.s.

Griffin's "Special" P.O.P.

Separate Toning and Fixing.

Wash prints for 10 minutes, then place in.—

Gold chloride	.. ..	1 gr.	23 gm.
Ammonium sulphocyanide	.. ..	10 grs.	23 gms.
Water	.. ..	10 ozs.	1000 c.c.s.

Griffin's Professional P.O.P.

Toning Bath.

Gold chloride	.. ..	1½ gr.	1 gm.
Ammonium sulphocyanide	.. ..	15 grs.	1 gm.
Water	.. ..	25 ozs.	700 c.c.s.

Goldona (Self-toning) Paper.

The prints are plunged straight into the fixing bath.

For warm tones, fix in 1.5 hypo for 15 minutes.

For colder tones, fix in 2.5 hypo for 10 to 15 minutes.

"Gaslyt" Lantern Plates.

Developer for Black Tones.

Water	.. ..	8 ozs.	1000 c.c.s.
Métol	.. ..	4 grs.	1.2 gm.
Sodium sulphite	.. ..	75 grs.	20 gms.
Hydroquinone	.. ..	16 grs.	4.6 gms.
Sodium carbonate	.. ..	280 grs.	80 gms.
Potassium bromide	.. ..	8 grs.	2.3 gms.

For Warm or Sepia Tones.

Solution (as for black tones)	..	..	1 oz.
Water	..	..	2 ozs.
Potassium bromide solution (10 per cent.)	..	..	10 drops

Rawlins' Oil-Pigment Paper.*Sensitizer.*

Potassium bichromate	..	..	1 oz.	50 gms.
Water	..	..	20 ozs.	1000 c.c.s.

Used for about one minute.

HALIFAX PHOTOGRAPHIC CO.**"Swiflex" Plates.***Developer.*

A. Pyro	...	...	$\frac{1}{2}$ oz.	16 gms.
Potass. metabisulphite	.	...	$\frac{1}{2}$ oz.	16 gms.
Potass. bromide	...	...	10 grs.	0.76 gm.
Water	...	...	30 ozs.	1000 c.c.s.
B. Sodium carbonate..	...	...	3 ozs.	100 gms.
Sodium sulphite	..	...	4 ozs.	133 gms.
Water	...	...	30 ozs.	1000 c.c.s.

Use equal parts of A and B, or increase B for soft effect.

"Trade" Plates.*Developer.*

A. Pyro	...	...	$\frac{1}{2}$ oz.	12.5 gms.
Potass. metabisulphite	.	...	30 grs.	3.4 gms.
Water	...	..	20 ozs	1000 c.c.s.
B. Soda carbonate (cryst.)	...	...	2 ozs.	100 gms.
Soda sulphite (cryst.)	..	...	2 ozs.	100 gms.
Potass. bromide	...	...	10 grs	1.14 gms.
Water	..	...	20 ozs.	1000 c.c.s.

Use equal parts of A and B

"Procex" Plates.*Developer.*

A. Pyro	...	...	1 oz.	20 gms.
Potass. metabisulphite	...	...	$\frac{1}{2}$ oz.	10 gms.
Potass. bromide	...	...	20 grs.	.91 gm.
Water to make	...	...	50 oz.	1000 c.c.s.
B. Sodium carbonate...	...	...	6 ozs.	120 gms.
Sodium sulphite	...	...	8 ozs.	160 gms.
Water to make	...	...	50 ozs.	1000 c.c.s.

Use equal parts of A and B.

"Lilywhite" P.O.P.*Combined Bath.*

Water (pure or distilled) hot	... 20 ozs.	1000 c.c.s.
Hypo ... ..	... 5 ozs.	250 gms.
Ammonium sulphocyanide	... 240 grs.	27.4 gms.
Citric acid ... ..	... 60 grs.	6.84 gms.
Lead acetate ... ..	... 60 grs.	6.84 gms.
Alum ... ..	... 60 grs.	6.84 gms.
Gold chloride (in solution)	... 3 grs.	0.34 gms.

Dissolve in the order named and use when cold. Use 1 gram of gold for 8 to 10 cabinets.

The separate toning baths (sulphocyanide, borax, and acetate) are also recommended for "Lilywhite" P.O.P.

SEPIA TONES ON MATT P.O.P.

For sepia tones use the salt bath and tone in—

Chloroplatinite of potash...	... 2 grs.	0.4 gm.
Dilute phosphoric acid ...	... $\frac{1}{2}$ oz.	50 c.c.s.
Water ... ..	... 10 ozs.	1000 c.c.s.

Then wash thoroughly and fix in—

Carbonate of soda ... ..	... $\frac{1}{2}$ oz.	12.5 gms.
Sulphite of soda ... ..	... 1 oz.	50 gms.
Hypo ... ..	... 4 ozs.	200 gms.
Water ... ..	... 20 ozs.	1000 c.c.s.

"Lilywhite" Self-toning P.O.P.

•

Fixing bath for brown to purple tones :—

Hypo ... ..	... 4 ozs.	200 gms.
Water ... ..	... 20 ozs.	1000 c.c.s.

For warmer tones this is used half-strength.

For colder tones five minutes' immersion in 10 per cent. salt bath is given prior to fixing.

"Lilywhite" Bromide Papers.*Developer.*

Soda sulphite ... ..	... 1 oz.	50 gms.
Amidol ... ..	... 50 grs.	5.7 gms.
Potass. bromide ... ..	... 15 grs.	1.7 gms.
Water ... ..	... 20 ozs.	1000 c.c.s.

WARM TONES DIRECT BY DEVELOPMENT.

Stock Solution.

Soda sulphite	...	...	4 ozs.	400 gms.
Potass. carbonate	...	...	3 ozs.	300 gms.
Warm water	...	...	10 ozs.	1000 c.c.s.
Aduroi	...	...	$\frac{1}{2}$ oz.	50 gms.

The proportions of exposure and dilution are as per the following scale:—

<i>Exposure.</i>	<i>Stock Solution.</i>	<i>Water.</i>	Additional		<i>Colour.</i>
			10% Bromide	<i>Solution.</i>	
Normal	1 oz.	10 ozs.	...	2 Drops	Black
One-and-a-half...	1 „	15 „	...	20 „	Cool sepia
Double	1 „	20 „	...	40 „	Sepia
Three times	1 „	30 „	...	60 „	Warm sepia
Four times	1 „	40 „	...	80 „	Brown

An acid fixing bath is to be preferred.

“Lilywhite” Gaslight Paper.

Developer.

Water (boiled or distilled) cold	...	20 ozs.	1000 c.c.s.
Metol	...	15 grs.	1.71 gms.
Sodium sulphite (cryst.)	...	540 grs.	61.6 gms.
Hydroquinone	...	60 grs.	6.84 gms.
Sodium carbonate	...	1080 grs.	123.1 gms.
Potass. bromide	...	3 grs.	.34 gms.

Dissolve in order named and keep well corked.

ILFORD, LTD,

Ilford Plates.

(“Ordinary,” “Zenith,” “Monarch,” “Climatic,” etc.)

PYRO-SODA DEVELOPER.

Stock Solutions.

A. Water	..	..	5 $\frac{1}{2}$ ozs.	150 c.c.s.
Nitric acid	..	..	20 minims	20 drops
Pyrogalllic acid	..	..	1 oz.	28 gms.

This solution will keep good for several weeks.

Or—

B. Water	..	..	5 $\frac{1}{2}$ ozs.	150 c.c.s.
Potass metabisulphite	..	..	70 grs.	5 gms.
Pyrogalllic acid	..	..	1 oz.	28 gms.

This solution will keep good for several months.

Working Solutions.

No. 1. Stock solution of pyro, A or B ..	1—2 ozs	25—50 c.c.s.
Water to make up to	20 ozs.	500 c.c.s.
No. 2. Sodium carbonate, crystals (not bicarbonate) (avoirdupois) ..	2 ozs.	100 gms.
Sodium sulphite (avoirdupois) ..	2 ozs.	100 gms.
Potassium bromide	20 grs.	2 gms.
Water to make up to	20 ozs.	1000 c.c.s.

For normal exposure take equal quantities of Nos. 1 and 2.

METOL-PYRO DEVELOPER.

This developer is fully as energetic as metol-hydroquinone. In dealing with unknown exposures it is best to start with equal parts of A and C, and add B and more of C if necessary afterwards.

A. Stock solution of pyro	2 ozs.	50 c.c.s.
Water up to	20 ozs.	500 c.c.s.
B. Metol	90 grs.	5 gms.
Potass metabisulphite	20 grs.	1 gm.
Potass bromide	45 grs.	2 gms.
Water up to	20 ozs.	500 c.c.s.
C. Sodium bicarbonate (crystals) (not bicarbonate)	2 ozs.	50 gms.
Sodium sulphite (crystals)	2 ozs.	50 gms.
Potass bromide	20 grs.	1.2 gm.
Water up to	20 ozs.	500 c.c.s.

Normal Developer —A, 1 part; B, 1 part; C, 2 parts.

METOL-HYDROQUINONE.

A Metol	60 grs.	3.5 gms.
Hydroquinone	90 grs.	5 gms.
Potass metabisulphite	90 grs.	5 gms.
Water up to	20 ozs.	500 c.c.s.
B. Sodium carbonate (crystals) ..	2 ozs.	50 gms.
Sodium sulphite (crystals)	2 ozs.	50 gms.
Potass bromide	20 grs.	1 gm.
Water up to	20 ozs.	500 c.c.s.

Ilford "Process" Plates.*Development of Line Negatives.*

A. Metol	30 grs.	2.3 gms.
Hydroquinone	150 grs.	11.4 gms.
Sodium sulphite	3½ ozs.	108 gms.
Water	30 ozs.	1000 c.c.s.
B. Potass carbonate	6 ozs.	200 gms.
Potass bromide	90 grs.	6.8 gms.
Water	30 ozs.	1000 c.c.s.

Use equal parts of A and B, develop for about one minute, then immerse in a weak solution of sodium citrate (or add a little to the developer), and complete development. Great density is thus obtained.

The negatives should be fixed in an acid-alum-hypo bath, and can then be dried quickly in moderate warmth.

Development of Screen Negatives.

A	Metol	..	..	..	40 grs.	4.6 gms.
	Hydroquinone	..	..	..	50 grs.	5.7 gms.
	Potass bromide	..	..	..	30 grs.	3.4 gms.
	Soda sulphite	..	..	..	80 grs.	9.1 gms.
	Water	..	..	..	20 ozs.	1000 c.c.s.
B.	Caustic potash	..	..	..	100 grs.	11.4 gms.
	Water	..	..	..	20 ozs.	1000 c.c.s.

Use equal quantities of A and B, fix in hypo (8 ozs. to the pint), "cut" with Farmer's reducer, clear with

Sulphuric acid	..	..	..	2 drachms	25 c.c.s.
Water	..	..	..	10 ozs.	1000 c.c.s.

and intensify by Monckhoven method.

Dye Bath for Three-Colour Work.

Stock Solution A

Pinaverdol	..	..	..	..	1 gm.
Warm absolute alcohol	..	..	..	..	1000 c.c.s.

The bathing solution is composed of : -

Solution A	..	..	..	..	4 parts
Ammonia, 880 pure	..	..	..	..	2 parts
Distilled water	..	..	..	..	200 parts

in which plates are immersed for three minutes.

Ilford P.O.P.*Hardening Bath.*

Alum	..	..	..	1½ oz.	45 gms.
Common salt	..	..	..	1 oz.	30 gms.
Water	..	..	..	20 ozs.	600 c.c.s.

in which prints are kept moving for 5 or 10 minutes.

Toning Bath.

No. 1.	Ammonium sulphocyanide	..	..	100 grs.	6.5 gms.
	Water	..	..	10 ozs.	300 c.c.s.
No. 2	Sodium sulphite	..	..	10 grs.	65 gm.
	Water	..	..	10 ozs.	300 c.c.s.

This solution must be made up only on the day of using; any left must be thrown away.

No. 3.	Gold chloride	..	..	15 grs.	1 gm.
	Water	..	..	15 ozs.	450 c.c.s.

For the usual toning bath, take 2 ozs. of each of Nos. 1 and 3, and make up to 20 ozs. with water.

For *warm* tones and Special P.O.P. add 1½ to 2 ozs. of No. 2 to the above bath just before toning, and withdraw prints according to tone desired.

Kalona (Self-Toning) Paper.

The prints, without previous washing, are slipped rapidly one by one face upwards into the following solution:—

Alum (powdered)	1½ ozs.	30 gms.
Ammonium sulphocyanide	20 grs.	1 gm.
Water	20 ozs.	400 c.c.s.

where they must be constantly turned over for five minutes. The prints should next be washed for ten minutes in running water or repeated changes, and fixed for ten minutes in a solution of—

Hypo	3 ozs.	75 gms.
Water	20 ozs.	500 c.c.s.

They are then finally washed for two hours in the same way as Ilford P.O.P.

In tropical climates the following may be used instead of the ordinary formula:—

Ammonium sulphocyanide	20 grs.	2.3 gms.
Chrome alum	20 grs.	2.3 gms.
Water	20 ozs.	1000 c.c.s.

The colour of the prints is not affected.

The alum and sulphocyanide solution may be omitted and the prints put into a solution of—

Common salt	1 oz.	50 gms.
Water	20 ozs.	1000 c.c.s.

for five minutes and then fixed, but the resulting tone is warmer than that obtained by the use of the sulphocyanide. It is, however, permanent. Prints treated in this way are not so suitable for enamelling.

Ilford Bromide Paper and Opals.

Metol-Hydroquinone Development.

No. 1. Metol	50 grs.	4 gms.
Hydroquinone	25 grs.	2 gms.
• Sodium sulphite	1 oz.	35 gms.
Water up to	20 ozs.	700 c.c.s.
No. 2. Sodium carbonate (crystals)	1 oz.	35 gms.
Potass. bromide	30 grs.	2.4 gms.
Water up to	20 ozs.	700 c.c.s.

Take equal quantities of No. 1 and No. 2

Ilford Gaslight Papers.

Developer.

Metol	5 grs.	0.3 gm.
Sodium sulphite	½ oz.	15 gms.
Hydroquinone	20 grs.	1.3 gms.
Sodium carbonate (crystals)	½ oz.	15 gms.
10 per cent. solution of potass. bromide	10 minims	0.6 c.c.s.
Water	10 ozs.	300 c.c.s.

This developer is also used for the "Ilford" Gaslight Lantern Plates

Ilford "Platona" (Platinum) Paper.*Developing Formula.—Stock Solution.*

Potass. oxalate	2 ozs.	72 gms.
Potass. phosphate	$\frac{1}{2}$ oz.	18 gms.
Water	14 ozs.	500 c.c.s.

This solution is better if slightly acid; if it is not so, 60 grs. (4 gms.) oxalic acid should be added. If potassium phosphate is unobtainable, the sodium phosphate may be substituted, but the former is preferable. Dissolve the salts in hot water, and allow to cool. This solution will keep indefinitely.

For use, take 1 part stock solution and 1 part water

Fixing.

Hydrochloric acid (pure)	1 oz.	20 c.c.s.
Water	80 ozs.	1600 c.c.s.

Immerse prints for about five minutes each in three consecutive baths, and then give them a final washing in water for fifteen minutes.

Ilford Lantern Plates.*Metol-Hydroquinone Developer.*

1. Metol	50 grs.	5.6 gms.
Hydroquinone	25 grs.	2.8 gms.
Sodium sulphite	1 oz.	50 gms.
Water up to	20 ozs.	1000 c.c.s.
2. Sodium carbonate	1 oz.	50 gms.
Potass. bromide	30 grs.	3.4 gms.
Water up to	20 ozs.	1000 c.c.s.

Equal parts of Nos. 1 and 2.

Hydroquinone Developer.

1. Hydroquinone	160 grs.	18.2 gms.
Sodium sulphite	2 ozs.	100 gms.
Water up to	20 ozs.	1000 c.c.s.
2. Sodium hydrate	80 grs.	9.1 gms.
Sodium sulphite	30 grs.	3.4 gms.
Water up to	20 ozs.	1000 c.c.s.

No. 1, 1 part: No. 2, 1 part; Water, 2 parts.

"Alpha" Lantern Plates.

The only suitable developer is:—

A. Hydroquinone	80 grs.	9.1 gms.
Sodium sulphite	1 oz.	50 gms.
Water to	20 ozs.	1000 c.c.s.
B. Sodium hydrate	30 grs.	3.4 gms.
Potass bromide	15 grs.	1.7 gms.
Water	20 ozs.	1000 c.c.s.

A, 1 oz. . B, 1 oz

The hydroquinone solution should not be used after it has become yellow, as it loses its developing power.

TONING AND FIXING BATH.

The plates must be thoroughly washed after development and are fixed and toned in one operation by means of a combined bath. The formula is :—

Hypo	.. .. .	2½ ozs	250 gms.
Ammonium sulphocyanide	... ..	¼ oz.	25 gms.
Gold chloride	.. .. .	4 grs.	·9 gms.
Water	.. .. .	10 ozs	1000 c.c.s.

The three salts should be dissolved in water and the gold chloride added last of all. A convenient plan is to dissolve the hypo and sulphocyanide in 6 oz. of water and then add 4 oz. of the stock solution of gold chloride (15 grains in 15 oz.) used to make up the toning bath for P.O.P. The bath should be made up a day or two before it is used.

When placed in this bath the plates fix rapidly and the image has a red or red brown colour if the exposure has been sufficient, but this colour gradually changes to brown, photographic purple, purple black, black, and finally blue, as the action of the bath is allowed to continue. The plate should be removed and well rinsed with water when its colour is somewhat warmer than that desired in the finished slide.

Of course if a red-toned slide is desired the plates should be simply fixed in plain hypo and if necessary modified by a short immersion in the toning bath. From 35 to 60 minutes toning is required in order to obtain a blue colour, photographic purple is obtained in about 15 minutes and purple black in about twenty-five.

THOS. ILLINGWORTH & CO.

Illingworth P.O.P.

• Ammonium sulphocyanide	.. .. .	20 grs.	2·8 gms.
Gold chloride	.. .. .	2 grs.	·28 gm.
Water	.. .. .	16 oz.	1000 c.c.s.

For red tones add to the above bath :—

Soda sulphite	.. .. .	2 grs.	·23 gms.
Water	.. .. .	20 oz.	1000 c.c.s.

COMBINED BATH.

Hypo	.. .. .	2 oz.	114 gms.
Lead acetate	.. .. .	16 grs.	2 gms.
Gold chloride	.. .. .	1 gr.	·15 gm.
Common salt	.. .. .	1½ oz.	85 gms.
Water	.. .. .	16 oz.	1000 c.c.s.

Dissolve hypo and acetate separately in warm water, using 8 ozs. of water for each, pour the lead acetate into the hypo solution, stirring vigorously, then add the salt and gold, allowing sediment to settle before using.

“Zigo” Self-Toning Papers.

For brown or purple tones place prints direct in

Hypo	4 oz. (4 tablespoonfuls)	200 gms.
Water	20 oz. (1 pint)	1000 c.c.s.

For red tones use half the above strength.

Illingworth Bromide Paper.

AMIDOL DEVELOPER.

Amidol	50 grs.	5 7 gms.
Sodium sulphite	600 grs.	70 gms.
Potass bromide	10 grs.	1·2 gms.
Water	20 oz.	1000 c.c.s.

To be used within three days of mixing.

“Zigas” Gaslight Paper.

DEVELOPER.

Metol	7 grs.	1 6 gm.
Hydroquinone	30 grs.	6·8 gm.
Sodium sulphite	220 grs	50 gm.
Sodium carbonate (crystals) ..	440 grs.	100 gm.
10% bromide of potassium	30 to 40 drops	100 to 120 drps
Water	10 ozs.	1000 c.c.s.

The prints are fixed in an acid bath.

IMPERIAL DRY PLATE CO., LTD.

Imperial Plates.

(“*Special Rapid*,” “*Flashlight*,” “*Orthochrome*,” and “*N.F.*”)

“STANDARD” DEVELOPER.

No. 1. Pyrogallie acid	55 grs.	6 gms.
Metol	45 grs.	5 gms.
Potass metabisulphite	120 grs.	14 gms.
Potass bromide	20 grs.	2 gms.
Water bottled or distilled) to ..	20 ozs.	1000 c.c.s
No. 2. Sodium carbonate (washing soda)	4 ozs.	200 gms.
Water (boiled or distilled) to ..	20 ozs.	1000 c.c.s

For use take equal parts of No. 1 and No. 2.

" UNIVERSAL " DEVELOPER.

No. 1.	Metol	.. ..	40 grs.	5 gms.
	Hydroquinone	.. ..	50 grs.	6 gms.
	Sodium sulphite	.. ..	120 grs.	14 gms.
	Potass bromide	.. ..	15 grs.	2 gms.
	Water (boiled or distilled) to	..	20 ozs.	1000 c.c.s.
No. 2.	Caustic potash	.. ..	180 grs.	21 gms.
	Water (boiled or distilled) to	..	20 ozs.	1000 c.c.s.

For use, take equal parts of No. 1 and No. 2.

PYRO-SODA DEVELOPER.

Stock Solution.

	Pyrogallie acid	.. ..	1 oz	83 gms.
	Potass bromide	.. ..	60 grs.	13 gms.
	Potass metabisulphite	.. ..	50 grs.	10 gms.
	Water (boiled or distilled) to	..	12 ozs.	1000 c.c.s.
No. 1.	Stock solution	.. ..	3 ozs.	150 c.c.s.
	Water (boiled or distilled)	..	20 ozs.	1000 c.c.s.
No. 2.	Sodium sulphite	.. ..	2 ozs.	100 gms.
	Sodium carbonate (washing soda)	.. ..	2 ozs.	100 gms.
	Water (boiled or distilled) to	..	20 ozs.	1000 c.c.s.

For use, take equal parts of No. 1 and No. 2.

In making up No. 1 solution dissolve the metol in 12 ozs. of water at 95°, and the sulphite in 4 ozs. at 95°; when both are completely dissolved mix and add the hydroquinone, and then the bromide, and make up to 20 ozs. For No. 2 begin with 16 ozs. of water at 95°.

HYDROQUINONE DEVELOPER

No. 1.	Hydroquinone	.. ..	150 grs.	16 gms.
	Potass metabisulphite	.. ..	10 grs.	1 gm.
	Potass bromide	.. ..	50 grs.	6 gms.
	Water (boiled or distilled) to	..	20 ozs.	1000 c.c.s.
No. 2.	Sodium sulphite	.. ..	2 ozs.	100 gms.
	Caustic soda	.. ..	100 grs.	11 gms.
	Water (boiled or distilled) to	..	20 ozs.	1000 c.c.s.

For use, take equal parts of No. 1 and No. 2.

After using this developer, always rinse the negative well before transferring to the fixing bath

SINGLE-SOLUTION DEVELOPER.

Metol	.. ..	50 grs.	5.5 gms.
Hydroquinone	.. ..	40 grs.	4.5 gms.
Sodium sulphite	.. ..	500 grs.	57 gms.
Potass bromide	.. ..	25 grs.	3 gms.
Sodium carbonate	.. ..	500 grs.	57 gms.
Water (boiled or distilled) to	..	20 ozs.	1000 c.c.s.

Imperial P.O.P.**SULPHOCYANIDE TONING BATH.***Stock Gold Solution.*

	Chloride of gold	15 grs.	18 gms.
	Water (distilled or boiled) to ..	15 drachms	1000 c.c.s.
No. 1.	Ammonium sulphocyanide ..	60 grs.	6.8 gms.
	Water (boiled or distilled) to ..	20 ozs.	1000 c.c.s.
No. 2.	Stock gold solution	5 drachms	31 c.c.s.
	Water to	20 ozs.	1000 c.c.s.

For use, take equal quantities of No. 1 and No. 2.

Add solution No. 2 slowly to solution No. 1, stirring all the time.

Imperial Self-Toning P.O.P.

Print exactly as P.O.P. and without any washing, immerse prints in—

	Ammonium sulphocyanide ..	20 grs.	2.3 gms.
	Powdered alum	1½ oz.	75 gms.
	Water	20 ozs.	1000 c.c.s.

The temperature of this bath should not be more than about 60°.

“Imperial” Bromide and Gaslight Papers.

A	Metol	50 grs.	5.7 gms.
	Hydroquinone	40 grs.	4.6 gms.
	Sodium sulphite	500 grs.	57 gms.
	Water to make	20 ozs.	1000 c.c.s.
B.	Potass bromide	25 grs.	2.8 gms.
	Sodium carbonate	500 grs.	57 gms.
	Water to make	20 ozs.	1000 c.c.s.

Equal quantities of A and B.

Imperial “Special” Lantern Plates are developed with the hydroquinone formula given above for negative plates.

Imperial “Gaslight” Plates are developed in a single solution made by dissolving all the chemicals of the bromide paper developer given above in 20 ozs. (or 1000 c.c.s.) of water.

KENTMERE, LTD.**“Kentmere” P.O.P.***Phosphate Toning Bath.*

	Gold chloride	2 grs.	.11 gms.
	Soda phosphate	60 grs.	3.42 gms.
	Water ... 40 ozs. or enough to cover prints.		1000 c.c.s.

This bath is recommended for toning cards or prints in quantities, 2 grains of gold toning about 150 or more post-cards. The more water

added the slower the toning. Use enough water to allow of cards being moved easily and quickly.

"Kentmere" Self-Toning P.O.P.

If purple tones are preferred, print until the shadows are completely blocked. For brown tones it is not necessary to print quite so darkly.

After printing place into one of the following fixing baths with or without previous washing. Do not let fixing bath be too cold.

For Red Brown Tones.

For Purple Tones.

Hypo ...	4 ozs.	Hypo ...	6 ozs.
Water ...	1 pint.	Water ...	1 pint.

Remove from bath immediately desired tone is reached, which should not be less than five minutes or more than eight.

"Kentmere" Bromide and Gas-Light Papers.

Developers.

BROMIDE.

GASLIGHT.

Metol ...	10 grs.	1·14 grms.	14 grs.	1·60 grms.
Hydroquinone	30 grs.	3·42 grms.	60 grs.	6·84 grms.
Water to	20 ozs.	1000 c.c.s.	20 ozs.	1000 c.c.s.

Dissolve and add—

Sodium sulphite				
cryst.	3 oz.	37·5 grms.	1 oz.	50 grms.
Sodium carbo-				
nate cryst	1 oz.	37·5 grms.	1 oz.	50 grms.
Potass. bromide.	10 grs.	1·14 grms.	6 grs.	0·68 grms.

KODAK LTD.

Kodak Film.

PYRO DEVELOPER.

Also for Film-pack and Kodoids.

A. Pyrogalllic acid	.. ..	1 oz.	30 grms.
Sulphuric acid	.. ..	20 minims	1 c.c.
Water	.. ..	28 ozs.	900 c.c.s.
B. Sodium sulphite	.. ..	6 ozs.	180 grms.
Sodium carbonate crystal	.. ..	6 ozs.	120 grms.
Water	.. ..	28 ozs.	900 c.c.s.

A, 1 oz. ; B, 1 oz. ; water, 8 ozs.

For Kodak developing machine, Brownie developing box (6 minute development) or Kodak tank developer (10 minute development) take A, 1 oz. ; B, 1 oz. ; water, 10 ozs.

Kodoid Plates and Fremo Film Pack

A. Metol	.. .. .	60 grs.	8 gms.
Hydroquinone	.. . . .	30 grs.	4 gms.
Sodium sulphite	. . . . .	1½ ozs.	80 gms.
Water	.. .. .	20 ozs	1000 c.c.s.
B. Sodium carbonate	.. . . .	1 oz	60 gms
Water	.. .. .	20 ozs	1000 c.c.s

A, 1 oz. ; B, 1 oz. , water, 2 ozs.

Add 1 or 2 drops 10 per cent. solution potassium bromide to each oz of developer.

Eastman Plates.

A. Water	.. .. .	32 ozs.	1000 c.c.s.
Potassium metabisulphite	. . . . .	60 grs	4 gms.
Potass. bromide	. . . . .	60 grs.	4 gms.
Pyro	.. .. .	1 oz.	30 gms.
B. Water	.. .. .	32 ozs.	1000 c.c.s.
Sodium sulphite	.. .. .	8 ozs.	250 gms.
C. Water	.. .. .	32 ozs.	1000 c.c.s.
Sodium carbonate	.. .. .	8 ozs.	250 gms.

A, 2 parts; B, 2 parts; C, 2 parts; water, 3 parts.

Seed Plates.*Developer.*

A. Pyro	.. .. .	1 oz.	60 gms.
Soda sulphite crystal	.. .. .	4 ozs	240 gms.
Sulphuric acid	.. .. .	5 drops.	none.
Water	.. .. .	16 ozs	1000 c.c.s
B Soda carbonate crystal	.. . . .	4 ozs.	240 gms
Water	.. .. .	16 ozs	1000 c.c.s.

For use, A, 1 oz B, 1 oz. ; water, 8 ozs.

Kodak Solio P.O.P.*Toning Bath Stock Solution.*

Gold chloride	.. .. .	15 grs. (1 tube)	1 gm.
Ammonium sulphocyanide	.. . . .	150 grs.	10 gms.
Water to	.. .. .	30 ozs.	1000 c.c.s

The sulphocyanide should be dissolved first and the gold added afterwards. Each ounce contains ½ gr. of chloride of gold.

To impart to a ls. packet of paper a cold purple-black tone take 6 ozs. of the stock solution and dilute with water to measure, say, 30 ozs. Treat all the prints at the same time, and allow them to remain in the bath for eight minutes, keeping them in motion as usual in toning.

For a purple-brown colour a packet of paper requires 3 ozs. of stock solution, or for a brown colour 1½ oz of stock solution, whilst 1 oz. of stock solution will give a red tone.

The amount of water to be added to the stock solution is in all cases just as much as is considered necessary for conveniently handling the prints.

Wash the batch of the prints well for 10 minutes in running water (or in three changes of water). Transfer as rapidly as possible the whole of them, one by one, to the toning bath.

Tone for 8 or 10 minutes, moving the prints all the time, and rinse well before fixing.

COMBINED BATH.

A. Hypo	6 ozs.	200 gms.
Ammonium sulphocyanide ..	48 grs.	4 gms.
Water	32 ozs.	1000 c.c.s.
B. Gold chloride	15 grs. (1 tube)	1 gm.
Lead acetate	150 grs.	10 gms.
Water	16 ozs.	500 c.c.s.

Take 7 parts of A to 1 part of B. Print decidedly darker than for ordinary bath. Wash thoroughly and tone in this bath.

Platinum Toning for Matt "Solio."

Potassium chloroplatinite ..	5 grs.	1 gm.
Citric acid	40 grs.	8 gms.
Sodium chloride (salt) ..	40 grs.	8 gms.
Water	20 ozs.	1000 c.c.s.

This bath keeps well for a month.

Wash the prints from 5 to 10 minutes, and then immerse in the above bath, examining the prints by transmitted light.

Tone to a dark brown or chocolate colour (not black), rinse slightly, and immerse the prints in the following bath to stop the toning action :—

Sodium carbonate (washing soda) $\frac{1}{2}$ oz.	15 gms.
Water	20 ozs. 600 c.c.s.

Rinse and transfer to the following fixing bath :—

Sodium hyposulphite	3 ozs.	150 gms.
Water	20 ozs.	1000 c.c.s.

Wash thoroughly in running water or in frequent changes for one hour.

DEVELOPING "SOLIO."

Develop with the following developer until the prints look similar to printed-out prints, but rather more brown in colour; this should take 5 or 6 minutes.

Hydroquinone	26 grs.	2 gms.
Citric acid	60 grs.	5 gms.
Sodium acetate	1½ oz.	50 gms.
Water	30 ozs.	1000 c.c.s.

Wash for about 15 minutes. The prints will continue to develop very slightly, and for this reason care should be taken not to develop them too dark. Then tone in the sulphocyanide or combined toning and fixing bath in the usual way.

Kodak "Solio" No. 2.

The sulphocyanide bath for cold tones is that already given for ordinary "Solio."

For warm tones the following stock solution is prepared:—

Gold chloride	.. .. .	15 grs.	1 gm.
Water	.. .. .	30 ozs.	1000 c.c.s.

Take 1 part of the stock solution to 10 parts of water. Neutralise exactly with a saturated solution of borax, add one drop at a time, stir and test with litmus paper, repeating this operation until the bath does not alter the colour of blue or red litmus paper. The borax bath is ready for use at once, but will not keep.

PLATINUM TONING FOR MATT SOLIO No. 2.

To obtain rich sepia tones make up the following stock solutions:—

Potassium chloroplatinite	.. .. .	15 grs.	1 gm.
Citric acid	.. .. .	2 drachms	8 gms.
Sodium chloride (common salt)	.. .. .	2 drachms	8 gms.
Water	.. .. .	30 ozs.	1000 c.c.s.

For use, take 1 part of the stock solution and add 20 parts of water. Tone until the high-lights are clear, which takes about 5 minutes, and then immerse the prints in the following bath to stop further toning:—

Sodium carbonate (washing soda crystals)	.. .. .	$\frac{1}{2}$ oz	15 gms.
Water	.. .. .	20 ozs.	600 c.c.s.

Again rinse and fix, etc., as already described

Kodak Collodio-Chloride Papers.

Matt.

When the prints are sufficiently washed and ready to tone, they are first placed in a plain gold bath, made alkaline with borax, enough to turn red litmus paper blue in one minute.

Gold chloride	.. .. .	2½ grs.	16 gms.
Water	.. .. .	60 ozs.	1700 c.c.s.

Add sufficient of a saturated solution of borax to make bath very slightly alkaline (about 25 to 30 drops). The bath should be made up one to two hours before use.

Tone in this bath to chocolate brown in the deepest shadows by transmitted light. Add gold enough to keep the speed of the bath 6 to 8 minutes. If the prints show bleaching in the half-tones before the shadows are toned far enough, add more borax. The alkali acts as a restrainer on the half-tones. The amount to use is the amount necessary to hold the half-tones from bleaching while the shadows tone. When the prints are toned, place in clear water; and when all are toned, wash in three changes of water and tone in platinum bath.

KODAK GLOSSY C.C. PAPER.

Print considerably darker than desired when finished and after washing tone in the following bath:—Water 60 ozs., kodak gold

solution 2 drachms (or, if dry chloride of gold is used, 2 grains), and $\frac{1}{2}$ drachm of dry acetate of soda. Add a few drops of saturated solution of borax, enough to make the bath slightly alkaline. Allow to stand 2 or 3 hours before using.

For Dark Tones.

Water	.. .. .	32 ozs.	900 c.c.s
Ammonium sulphocyanide	.. .. .	$\frac{1}{2}$ oz.	14 gms.
Gold chloride	.. .. .	2 grs.	0.13 gms.

ARISTO-PLATINO AND ARISTO JUNIOR

C.C. Papers

Gold Toning Baths.

Salt	.. .. .	30 grs.	0.68 gms.
Gold chloride	.. .. .	4 grs.	0.1 gm.
Water	.. .. .	100 ozs.	1000 c.c.s.

Add saturated borax solution enough to turn red litmus paper blue in half a minute.

Salt	.. .. .	20 grs.	0.9 gms
Sodium acetate (saturated solution)	.. .. .	$\frac{1}{2}$ oz	8 c.c.s
Gold chloride	.. .. .	2 grs	0.07 gms
Water	.. .. .	60 ozs.	1000 c.c.s.

Add saturated solution of soda carbonate or borax, enough to turn red litmus paper blue in 1 to 2 minutes. Bath should tone in 6 to 8 minutes.

For dark tones on "Aristo Junior," the sulphocyanide bath given for Glossy C.C. paper is used.

Kodak Self-Toning Papers.

"SOLIO" (GELATINE) P.O.P.

Put the prints, without previous washing, into the following bath, and keep them moving for 3 to 5 minutes.

Ammonium sulphocyanide	.. .. .	20 grs.	2 gms.
Water	.. .. .	20 ozs.	1000 c.c.s.

Wash for 5 minutes in running water, or several changes, and fix in—

Hypo	.. .. .	3 ozs.	150 gms.
Water	.. .. .	20 ozs.	1000 c.c.s.

for 10 minutes. Then wash in running water for one hour, or in 15 to 16 changes.

The following alternative baths will give good warm tones on both grades of paper, but is specially recommended for matt. Put the prints, without previous washing, into the following bath:—

Salt	.. .. .	1 oz.	50 gms.
Water	.. .. .	20 ozs.	1000 c.c.s.

for 5 minutes, and then place in the above fixing bath.

COLLODION GLOSSY AND MATT.

For cold, purple brown tones, immerse without previous washing directly into hypo, $2\frac{1}{2}$ ozs.; water, 20 ozs., for 10 minutes.

For warm brown tones, wash in three changes of cold water, and transfer for 10 minutes to fixing bath.

For rich purple black tones, put the print directly into salt, 60 grs.; water, 20 ozs., for three minutes, and then transfer to the fixing bath for 10 minutes.

"ARISTO" COLLODION

For Warm Tones.

Wash in two changes and fix for 15 minutes in 1:8 hypo, made slightly alkaline with ammonia; transfer for 10 minutes to 1:20 salt bath and wash.

For Cold Tones.

Treat for 5 minutes in 1:60 salt bath, take out into clean water, fix for 15 minutes in 1:8 hypo bath, and transfer (for 10 minutes) to 1:20 salt bath, finally washing as usual.

Kodak Bromide Papers.

"Permanent," "Platino-Matte," "Royal," "White Royal," "Nikko," and "Velvet."

Metol-Hydroquinone Developer.

Metol	8 grs.	9 gms.
Hydroquinone	..	..	..	30 grs.	3.5 gms.
Sodium sulphite	..	..	..	$\frac{3}{4}$ oz.	38 gms.
Sodium carbonate	..	..	..	$\frac{3}{4}$ oz.	38 gms.
10% solution potassium bromide	..	..	..	20 minims	1 c.c.
Water	..	..	..	20 ozs.	1000 c.c.s.

Amidol Developer.

Amidol	..	..	..	60 grs.	1.8 gm.
Sodium sulphite	..	..	..	1 oz.	50 gms.
10% solution potassium bromide	..	..	..	20 drops	1.5 c.c.s.
Water	..	..	..	20 ozs.	1000 c.c.s.

HYPO-ALUM SEPIA TONING.

Hypo	..	..	..	10 ozs.	280 gms.
Alum	..	..	..	1 oz.	28 gms.
Boiling water	..	..	..	70 ozs.	2000 c.c.s.

Dissolve the hypo in the water, and then add the alum slowly. When all is dissolved the solution should be milk white. This solution should not be filtered, and it works better as it becomes older; it may be strengthened from time to time with a little fresh solution. Never throw the bath away entirely, but replenish it in the manner stated. The best results are obtained on prints developed by the above amidol formula, and by keeping the bath hot, or as warm as the emulsion will stand, say 100 to 120 degrees F. In this bath prints will tone in 30 to 40 minutes.

When toned, the prints should be placed in a tepid solution of—

Water	.. .. .	70 ozs.	2000 c.c.s.
Alum	.. .. .	2 ozs.	60 gms.

then washed thoroughly.

Kodak "Dekko" (Gaslight) Paper.

Developer.

Hydroquinone	.. .. .	30 grs.	3 5 gms.
Metol	.. .. .	7 grs.	8 gms.
Sodium sulphite	.. .. .	220 grs.	25 gms.
Sodium carbonate	.. .. .	400 grs.	45 gms.
Potassium bromide (10% sol)	.. .. .	10 drops	16 drops
Water up to	.. .. .	20 ozs.	1000 c.c.s.

A fixing bath of the "acid" type (hypo, sulphite, acetic acid, and alum) should be used.

Kodak Platinum Paper.

Developer for Warm Black Tones

Neutral potassium oxalate	.. .. .	4 ozs.	200 gms.
Water	.. .. .	20 ozs.	1000 c.c.s.

For Blue Tones

Neutral potassium oxalate	.. .. .	2 ozs.	100 gms.
Potassium phosphate	.. .. .	1 oz.	50 gms.
Water	.. .. .	20 ozs.	1000 c.c.s.

Any potassium phosphate will do for this developer, but the one which gives by far the best results, and should be used if obtainable, is the mono-potassium di-hydric ortho-phosphate (KH_2PO_4).

The temperature of the developer should be from 60° to 65° F.

Clearing baths.—Hydrochloric acid, $\frac{1}{2}$ oz ; water, 20 ozs.

"Eastman" Lantern Plates.

Gaslight—For Warm Tones.

A. Water	.. .. .	16 ozs.	600 c.c.s.
Hydroquinone	.. .. .	120 grs.	10 gms.
Sodium sulphite (crystals)	.. .. .	1 oz.	30 gms.
B. Water	.. .. .	16 ozs.	600 c.c.s.
*Caustic soda	.. .. .	60 grs.	5 gms.
Potassium bromide	.. .. .	60 grs.	5 gms.
C. Water	.. .. .	16 ozs.	600 c.c.s.
*Ammonium carbonate	.. .. .	120 grs.	10 gms.
Ammonium bromide	.. .. .	120 grs.	10 gms.

* The caustic soda should be fresh and dry. The ammonium carbonate should be in clear lumps. If covered with white, powdery bicarbonate from exposure to the atmosphere, this should be scraped off before weighing.

For brown tones: A, 1 oz. ; B, 1 oz. ; and C, 2 drachms.

For purple tones: A, 1 oz. ; B, 1 oz. ; and C, 3 drachms.

For red tones expose longer and use developer for purple tones.

LETO PHOTO-MATERIALS CO., LTD.

Leto-Platino-Matt Collodion Paper.

For Brown-Black and Warm Black Tones

The prints are first partly toned in the following gold bath. Toning must not be carried on too far, but only until the prints seem to have changed colour. A long immersion will yield blue-black and a short immersion brown-black tones in the subsequent platinum bath.

Shortly before use only, make up as follows:—

Acetate of soda	..	..	1 oz	30 gms.
Gold chloride	..	..	1 gr	0.065 gms
Water	..	..	17 ozs.	530 c.c.s.

After toning, wash for a minute or two, and continue in the following platinum bath, until the desired effect has been obtained:—

Phosphoric acid	..	..	2 drachms	7 l.c.s.
Chloroplatinite of potash	..	..	7½ grs.	0.48 gms.
Water	..	..	9 ozs.	250 c.c.s.

Then wash in two to three changes of water and fix.

Rich Sepia and Red-Brown Tones.

Rich sepia and red-brown tones are obtained by diluting the above solutions with an equal quantity of water, and proceeding in the same way as for black tones.

Toning in the gold bath must only be carried on until the high lights are clear.

In the platinum bath the prints must only be immersed for a few moment and then fixed as usual.

Dark sepia tones can be obtained by using the platinum bath as given above, without the gold bath, but 10 to 12 ozs. of water should be taken in place of the 9 ozs.

“Juno” Collodion P.O.P.

Toning Bath.

Ammonium sulphocyanide	..	90 grs.	10.3 gms.
Gold chloride	..	3 grs.	0.3 gm.
Water	..	20 ozs.	1000 c.c.s.

Fix for at least fifteen minutes in:—

Hypo	..	1 oz.		Water	..	15 ozs.
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“Pluto” Collodio-chloride Paper.

Platinum Toning Bath.

Citric acid	..	90 grs.	10.3 gms.
Potass. chloroplatinite	..	3 grs.	0.3 gm.
Water	..	20 ozs.	1000 c.c.s.

Brown Tones.—Do not print so deeply as for black tones. Wash in four changes of lukewarm water, and immerse in a very weak

ammonia bath (say $\frac{1}{2}$ oz. to 40 ozs. water) until they turn a uniform lemon yellow. Wash out the ammonia from the prints in at least six changes of water, and tone in the above platinum bath, and fix as usual. (It is important that the prints be free from ammonia to avoid staining in the platinum bath.)

Excellent warm sepia tones are obtained by first washing the prints as usual, and placing direct into the fixing bath (hyposulphite of soda, 1 oz., water, 15 ozs.). Fix for 15 minutes, and wash for 1 to $1\frac{1}{2}$ hours in several changes. Printing must not be carried on so far as for warm black tones.

Seltona (Self-toning) Collodion Paper.

For Warm Brown Tones.

Soak the prints for a minute or two in clean water, and place in the fixing bath as follows:—

Hypo	..	..	..	..	2 ozs.	100 gms.
Water	..	..	..	..	20 ozs.	1000 c.c.s.

Fix for about 10 minutes, then wash for 1 hour in running water, or 8 to 10 changes.

Dark Brown, Purple and Blue Tones.

Soak the prints for a minute or two in clean water, and place for 7 to 10 minutes in the following:—

Common salt	..	..	..	..	..	1 oz.
Water	..	..	..	..	..	12 ozs.

or 4 good teaspoonfuls to $\frac{1}{2}$ pint water.

Rinse in clean water and fix as above.

Darker and bluer tones are obtained by placing the prints direct into the salt solution without previous washing.

A stronger solution of salt up to 2 ozs. in 10 ozs. may be employed if desired.

Leto-Tintona Paper.

For sepia tones the films are fixed in 10% hypo after washing.

For brown and purple tones, they are printed a little deeper and placed direct into—

Common salt	..	..	..	1 oz.	100 gms.
Water	..	..	..	10 ozs.	1000 c.c.s.

For black tones, the paper is much over-printed and toned in—

Citric acid	..	..	..	90 grs.	10 3 gms.
Sodium chloride	..	..	..	90 grs.	10 3 gms.
Potass. chloroplatinite	..	..	..	3 grs.	34 gm.
Water	..	..	..	20 ozs.	1000 c.c.s.

This bath is also used for Leto "Chamois" paper.

Leto "Bromide" Paper.*Amidol Developer.*

Amidol	45 grs.	5.1 gms.
Soda sulphite	450 grs.	51 gms.
Potass bromide	5 grs.	.6 gm.
Water	20 ozs.	1000 c.c.s.

An "acid" fixing bath is preferable: Soda sulphite, $1\frac{1}{4}$ oz.; water, 50 ozs., to which add, drop by drop, glacial acetic acid, 2 drachms, and then hypo, 8 ozs.

Leto-Gaslight Paper.*For Warm Black Tones.*

A Adurol-Schering	$\frac{1}{2}$ oz.	7.1 gms.
Soda sulphite, cryst.	2 ozs.	56.7 gms.
Water	$12\frac{1}{2}$ ozs.	350 c.c.s.
B Potass. carbonate.	$1\frac{1}{2}$ oz.	42.5 gms.
Water	$12\frac{1}{2}$ ozs.	350 c.c.s.

Shortly before use, mix equal parts of each.

For Pure Black Tones.

Sodium carbonate	$1\frac{1}{2}$ ozs	150 gms.
Sodium sulphite	$\frac{1}{2}$ oz.	25 gms.
Metol	10 grs	2.3 gms.
Hydroquinone	30 grs.	6.8 gms.
Potass. bromide (10 per cent. solution)	4 minims	9 c.c.s.
Water	10 ozs.	1000 c.c.s.

For correct exposure development should be complete in 10 to 30 seconds.

It is advisable to give plenty of exposure, and develop quickly. When fully developed rinse and fix

Leto Pigment Paper.*Sensitizer.*

Ammonium bichromate	450 grs.	50 gms.
Sodium carbonate (cryst.)	90 grs.	10 gms.
Water, to make	20 ozs.	1000 c.c.s.

For use, dilute one part with two parts of methylated spirit and use immediately.

THE LUMIERE CO.**Lumiere Plates and Films.***Dianol (Diamidophenol).*

Sodium sulphite anhydrous	40 grs.	5 gms.
Dianol	250 grs.	30 gms.
Water	20 ozs.	1000 c.c.s.

This solution should be used quite fresh.

A stock solution of the soda sulphite and water may be made and the dianol added dry in proportionate quantity at time of using.

Lumiere's Citrate P.O.P.

Any of the ordinary toning methods may be employed, but the makers specially recommend the use of the following combined toning and fixing bath.

A. Hypo	..	..	..	5 ozs.	250 gms.
Alum	..	..	..	150 grs.	15 gms.
Lead acetate	..	..	..	17 grs.	2 gms.
Warm water	..	..	..	20 ozs.	1000 c.c.s.

Dissolve the hyposulphite and alum, and when cold add the lead acetate. Allow to stand for several hours, and then filter carefully.

B. Gold chloride	..	..	..	15 grs.	1 gm.
Water	..	..	..	3½ ozs.	100 c.c.s.

To 100 parts of A add from 6 to 8 parts of B, according to tone required.

Separate Toning and Fixing.

Refined chalk	..	..	..	1½ oz.	80 gms.
1 per cent. solution of gold chloride	..	..	..	2 ozs.	100 c.c.s.
Distilled water	..	..	..	20 ozs.	1000 c.c.s.

Allow to stand for 24 hours, then filter, and for use add 15 parts of above bath to 100 parts of water.

After toning, rinse prints and transfer to a 1 per cent. solution of alum for a few minutes, wash well, and fix in—

Fixing Bath.

Hypo	..	..	..	3 ozs.	150 gms.
Soda bisulphite	..	..	..	1½ drachm	10 c.c.s.
Alum	..	..	..	30 grs.	3 gms.
1 per cent. solution of lead nitrate	..	..	..	2 drachms	15 c.c.s.
Water	..	..	..	20 ozs.	1000 c.c.s.

In this bath the prints will turn to a yellowish red, but will then change rapidly through brown to blue. Take the prints from the bath when the desired tone is obtained, and wash, preferably in running water.

Lumiere "Actinos" P.O.P.

Separate Toning.

A. Sodium acetate	..	..	..	350 grs.	40 gms.
Water	..	..	..	20 ozs.	1000 c.c.s.
B. Ammonium sulphocyanide	..	..	..	175 grs.	20 gms.
Water	..	..	..	20 ozs.	1000 c.c.s.
C. Gold chloride	..	..	..	15 grs.	1 gm.
Water	..	..	..	3½ ozs.	100 c.c.s.

Mix at time of use, A, 4 parts; B, 4 parts; C, 1 part.

Lumiere Bromide Papers.

The developer most recommended is as follows:—

Sodium sulphite (anhydrous) ..	170 grs	20 gms.
Dianol	45 grs.	5 gms.
10 per cent. solution of potass. bromide	20 to 50 min.	2 to 5 c.c.s.
Water	20 ozs.	1000 c.c.s.

This developer should be freshly made for each batch of prints, but should it be desired the soda solution can be made in bulk, and the diamidophenol added at the time of use.

Lumiere "Radios" (Gaslight) Paper.

Developer for Black Tones.

Sodium sulphite (anhydrous) ..	5 to 7 drachms	30 to 50 gms.
Dianol	40 grs.	5 gms.
Potass. bromide (10 per cent. solution)	25 drops	40 drops
Water	20 ozs.	1000 c.c.s.

For Warm Tones.

Hydroquinone	5 drachms	10 gms.
Formosulphite	14 drachms	25 gms.
Potass. bromide (10 per cent. solution)	1½ drachm	10 c.c.s.
Water	20 ozs.	250 c.c.s.

Autochrome Plates.

For the new developing formulae recommended by the makers see under "Colour Photography," in "Epitome of Progress." The other formulae are as follows:—

Reversing Solution.

C. Potass permanganate	2 gms.	70 grs.
Sulphuric acid	10 c.c.s.	6½ drams.
Water	1000 c.c.s.	80 ozs.

The sulphuric acid in C is the strong acid of 1·8 specific gravity. It should be added to the water, not *vice versa*.

Second Developer (Positive).

D. Soda sulphite (cryst.)	30 gms	260 grs.
Diamidophenol*	5 gms.	45 grs.
Distilled water	1000 c.c.s.	20 ozs.

* Amidol, or Dianol.

Destroying Second Developer.

E. Solution C.	20 c.c.s.	1 oz.
Water	1000 c.c.s.	50 ozs.

Intensifier.

F. Pyro	..	..	..	3 gms.	26 grs.
Citric acid.	..	..	..	3 gms.	26 grs.
Water	..	..	..	1000 c.c.s.	20 ozs.
G. Silver nitrate	..	..	..	5 gms.	90 grs.
Distilled water	..	..	..	100 c.c.s.	4 ozs.

Clearer.

H. Water	..	..	..	1000 c.c.s.	20 ozs.
Potass permanganate	..	..	..	1 gm.	9 grs.

Fixing Solution.

I. Hypo	..	..	..	150 gms	3 ozs.
Soda bisulphite (solution)	..	..	..	50 c.c.s.	1 oz.
Water	..	..	..	1000 c.c.s.	20 ozs.

Potass metabisulphite (7 gms. or 60 grs.) may be used in place of the soda bisulphite solution in making the fixing bath.

MARION AND CO., LTD.**Marion Plates.**

("Supreme," "Academy," P.S., etc.)

PYRO-SODA DEVELOPER

A. Pyrogallic acid	..	..	..	1 oz.	50 gms.
Sodium sulphite	..	..	..	8 ozs.	400 gms.
Sulphuric acid	..	..	..	60 minims	6 gms.
Water to make up	..	..	..	80 ozs.	250 c.c.s.
B. Sodium carbonate	..	..	..	8 ozs.	400 gms.
Potassium bromide	..	..	..	60 grs.	6 gms.
Water to make up	..	..	..	80 ozs.	250 c.c.s.

Mix in equal parts at time of using.

When very soft negatives are required or only a minimum exposure can be given, the bromide may be omitted.

PYRO-AMMONIA.

A. Pyrogallic acid	..	..	..	1 oz.	100 gms.
Ammonium bromide	..	..	..	1 oz.	100 gms.
Citric acid	..	..	..	60 grs.	12 gms.
Water to make up	..	..	..	10 ozs.	1000 c.c.s.
B. Strongest liquid ammonia (880)	..	..	..	1½ oz.	150 c.c.s.
Water to make up	..	..	..	10 ozs.	1000 c.c.s.

Two ozs. (200 c.c.s.) of each of above separately made with water to 20 ozs. (1000 c.c.s.) form the solutions for use, equal parts being mixed together at the time of development.

Mariona P.O.P.*Toning Bath for Matt and Glossy*

- A. Gold chloride solution, 1 gr. per oz. (2 3 gms. per 1000 c.c.s.).
 B. Ammonium sulphocyanide solution, 10 grs per oz. (23 gms. per 1000 c.c.s.).
 A, 1 oz.; B, 1 oz.; water to 8 to 12 ozs.

For Glossy Only.

- A. Gold chloride, as above.
 B. Sodium carbonate 30 grs. 4 6 gms.
 Water 15 ozs. 1000 c.c.s.
 A, 2½ ozs.; B, 2½ ozs.; water to make 20 to 30 ozs.

Platinum Toning for Matt P.O.P. and Mezzotint Paper

- A. Potass chloroplatinite 15 grs. 2 3 gms.
 Water 15 ozs. 1000 c.c.s.
 Hydrochloric acid 5 minims 0·3 c.c.
 B. Citric acid 300 grs. 4·6 gms.
 Sodium chloride 300 grs. 4·6 gms.
 Water 15 ozs 1000 c.c.s.
 A, 1 oz.; B, 1 oz.; water to 30 ozs

Marion's Collodion P.O.P.*For Warm Black Tones—Platinum Toning Bath.*

- Potass chloroplatinite 15 grs. 1 gm.
 Phosphoric acid (s.g. 1·120) 2½ drachms 9 c.c.s.
 Water 35 ozs. 1000 c.c.s.

Remove prints as soon as they are of desired tone, which will be in from two to six minutes, according to age of bath. Wash well before fixing.

Blue-Black Tones—Gold Toning Bath.

- Gold chloride 2 grs. ·13 gm.
 Borax 80 grs. 5 gms.
 Water 25 ozs. 700 c.c.s.

Make up two hours before use.

Keep prints in this bath until they assume a purple tone, then wash in several changes of water and transfer to platinum bath (given above). Remove when they reach a rich black. If prints do not remain long enough in platinum bath they will be blue-black with impure half-tones.

Wash after toning for half an hour in five or six changes of water, then fix.

Sepia Tones.

Wash prints in five or six changes of luke-warm water, to the last three of which add 1 per cent. of liquid ammonia ·880 (not stronger, or blisters will be produced). When lemon-yellow wash in five or six changes of water and tone in the platinum bath. Wash and fix as usual.

Red Carbon Tones.

Wash prints in three changes of water, then place in a bath of—

Common salt	..	..	..	..	1 teaspoonful
Water	..	..	..	..	40 ozs.

As soon as they become yellow remove, rinse in water, and place in the borax gold bath. Just as they are reaching tone desired again, place them in salt bath to stop further toning, and, after rinsing in water, fix as usual.

Brown and Dark-Blue Tones.

Print dark, and treat as for red carbon tones, but tone in platinum bath only.

Purple Tones.

Print very dark. Wash in three changes of water and place in the following bath:—

Gold chloride (1 per cent. solution)	..	..	..	1 oz.	10 c.c.s.
Acid hydrochloric pure	..	..	..	3 ozs.	30 c.c.s.
Water	..	..	..	10 ozs.	100 c.c.s.

Less acid gives a blue tone. More acid gives a purple tone. Tone until desired colour is obtained. Wash and fix as usual.

Marion Matt-Albumen Paper.*(Gold-Platinum Toning.)*

Tone for from $\frac{1}{2}$ to 5 minutes in:—

Sodium acetate	..	..	..	22 grs.	2.5 gms.
Sodium carbonate	..	..	..	4½ grs.	.5 gm.
Gold chloride	..	..	..	1 gr.	.11 gms.
Water	..	..	..	20 ozs.	1000 c.c.s.
and transfer directly into the platinum bath:—					
Potass chloroplatinite	..	..	..	15 grs.	1 gm.
Phosphoric acid (s.g. 1.120)	..	..	..	½ oz.	14 c.c.s.
Water	..	..	..	30 ozs.	850 c.c.s.

which is best used fresh.

Marion's Bromide Paper.*Amidol Developer.*

Amidol	..	..	..	40 grs.	4.6 gms.
Sodium sulphite	..	..	..	400 grs.	46 gms.
Potass bromide	..	..	..	10 grs.	1.1 gm.
Water to make up to	..	..	..	20 ozs.	1000 c.c.s.

Or other standard developer.

Marion's "Quick Print (Gaslight)" Paper.*Amidol Developer.*

Sodium sulphite	..	..	..	200 grs.	46 gms.
Amidol	..	..	..	20 grs.	4.6 gms.
Potass bromide (10% solution)	..	..	..	10 drops	35 drops
Water	10 ozs.	1000 c.c.s.

Adurol Developer for Cold Tones.

Adurol	20 grs.	4.6 gms.
Sodium carbonate	200 grs.	46 gms.
Sodium sulphite	200 grs.	46 gms.
Potass bromide	5 grs.	1 gm.
Water to	10 ozs.	1000 c.c.s.

Time of exposure with average negative, one inch magnesium ribbon burnt at one foot distant. Time of development, one minute.

Developer for Warm Tones.

Adurol	20 grs.	2.3 gms.
Sodium carbonate	200 gr.	23 gms.
Sodium sulphite	200 grs.	23 gms.
Potass bromide	25 grs.	3 gms.
Water to	20 ozs.	1000 c.c.s.

Time of exposure with average negative, six inches magnesium ribbon burnt to one foot distant. Time of development, four minutes.

Should the prints show a lack of purity in the whites, add to the developer a few drops more of 10 per cent. bromide solution.

Marion's Lantern Plates.

(Gelatin-chloride and Chloro-bromide.)

Hydroquinone	15 grs.	3.4 gms.
Metol	5 grs.	1.1 gms.
Sodium sulphite	200 grs.	45.6 gms.
Potass bromide	2 grs.	.45 gms.
Sodium hydrate	20 grs.	4.6 gms.
Water to make	10 ozs.	1000 c.c.s.

MAWSON AND SWAN.**Mawson Plates.**

("Mawson," "Felix," "Celeritas," "Electric," and "Castle.")

PYRO-AMMONIA DEVELOPER.—(10 per cent.)

Pyrogallic acid	480 grs.	110 gms.
Ammonium bromide	240 grs.	55 gms.
Potass metabisulphite	480 grs.	110 gms.
Distilled water to make up (fl.)	10 ozs.	1000 c.c.s.

Dissolve the metabisulphite in part of the water, then add the other ingredients, and make up to bulk with water,

A. Stock solution	300 minims	62 c.c.s.
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.
B. Liquid ammonia (.880)	70 minims	14.5 c.c.s.
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.

Use equal parts of A and B mixed at time of developing.

PYRO-SODA DEVELOPER.

Stock Solution.

Pyrogallie acid	480 grs.	110 gms.
Potass metabisulphite	120 grs.	28 gms.
Distilled water to make	10 ozs.	1000 c.c.s.

Dissolve the metabisulphite before adding the other ingredients.

A. Stock solution	600 minims	125 c.c.s.
Distilled water to make	10 ozs.	1000 c.c.s.

B. Sodium carbonate (crystal)	480 grs.	110 gms.
Sodium sulphite	640 grs.	146 gms.
Distilled water to make	10 ozs.	1000 c.c.s.

Use equal parts of A and B.

Mawson Ortho Plates.

The above pyro-soda formula, with the addition of 40 grs. (9 gms.) potass bromide to the stock solution, gives excellent results.

If under-exposed, use a large proportion of B; if over-exposed, decrease the proportion of B, and add a few drops of a 10 per cent. solution of potass bromide.

AMIDOL DEVELOPER.

Amidol	100 grs.	23 gms.
Soda sulphite	1000 grs.	228 gms.
Potass bromide	10 grs.	2.3 gms.
Distilled water to make to	10 ozs (fl.)	1000 c.c.s.

Use 1 part to 3 parts water.

Mawson Photo-mechanical Plates.

PYRO-AMMONIA DEVELOPER.

A. Pyrogallie acid	30 grs.	7 gms.
Ammonium bromide	30 grs.	7 gms.
Potass metabisulphite	30 grs.	7 gms.
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.

B. Liq. ammoniac (880)	70 minims	14.5 c.c.s.
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.

Use equal parts of A and B mixed at time of developing.

HYDROQUINONE DEVELOPER.

A. Hydroquinone	40 grs.	9 gms.
Potass bromide	10 grs.	2 gms.
Potass metabisulphite	40 grs.	9 gms.
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.

B. Caustic potash (sticks)	80 grs.	18 gms.
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.

Use equal parts of A and B mixed at time of developing.

Mawson Lantern Plates.

A negative of average density requires about 15 seconds at 1 foot from a No. 6 bat's-wing burner. Short exposure tends to produce black tones; long exposure, brown tones.

Either of the following developers may be used, though we give the preference to the pyro-ammonia, greater variety of tone being available by it.

Development begins rather slowly, especially with the hydroquinone formula, afterwards proceeding more rapidly.

PYRO-AMMONIA DEVELOPER.

A. Pyrogallie acid	20 grs.	4.5 gms.
Ammonium bromide	20 grs.	4.5 gms.
Potass metabisulphite	50 grs.	11.5 gms.
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.
B. Liq. ammonia ('880)	70 minims	15 c.c.s.
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.

Use equal parts of A and B mixed at time of developing.

HYDROQUINONE DEVELOPER.

A. Hydroquinone	40 grs.	9 gms.
Potass bromide	40 grs.	9 gms.
Potass metabisulphite	40 grs.	9 gms.
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.
B. Caustic potash (sticks)	80 grs.	18 gms.
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.

Use equal parts of A and B mixed at time of developing.

Clearing Solution.

Hydrochloric acid	$\frac{1}{2}$ oz. (fl.)	50 c.c.s.
Saturated solution of alum, to..	10 ozs. (fl.)	1000 c.c.s.

SULPHOCYANIDE TONING SOLUTION.

(For Blue-Black and Blue Tones.)

A. Gold chloride	15 grs.	1 gm.
Distilled water to make up ..	$7\frac{1}{2}$ ozs. (fl.)	212 c.c.s.
B. Ammonium sulphocyanide ..	40 grs.	3 gms.
Distilled water to make up ..	4 ozs. (fl.)	113 c.c.s.

Use 1 part of A and 4 parts of B, mixed at time of using. This order of mixing must not be reversed.

Mawson "Simplex" Lantern Plates.

Developer for Black Tones.

Amidol	100 grs.	20 gms.
Sodium sulphite	1000 grs.	200 gms.
Potass bromide	5 grs.	1 gm.
Distilled water to make ..	10 ozs.	1000 c.c.s.

Use 1 part to 4 parts of water.

Developer for Brown Tones.

A. Hydroquinone	20 grs.	4 gms.
Potass metabisulphite	20 grs.	4 gms.
Potass bromide	20 grs.	4 gms.
Distilled water to make	10 ozs.	1000 c.c.s.
B. Potass carbonate	500 grs.	100 gms.
Soda sulphite	100 grs.	20 gms.
Distilled water to make	10 ozs.	1000 c.c.s.

Use equal parts of A and B.

OZOBROME, LIMITED.

THE OZOBROME PROCESS.

Carbon Prints from Bromides

Bromides should be fixed in a hardening-fixing bath of—

Hypo	12 ozs.	340 gms.
Potass metabisulphite	1 oz.	30 gms.
Chrome alum	1 oz.	30 gms.
Water	80 ozs.	2000 c.c.s.

If fixed in the ordinary bath, the bromides should be hardened in—

Formalin	1 part	water 10 parts.
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or—

Chrome alum	4 per cent. solution.
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in either case for ten minutes.

Acid Bath.—A.

Hydrochloric acid (pure)	1 drachm	5 c.c.s.
Water	25 ozs.	1000 c.c.s.

Pigmenting Bath.—B.

Concentrated ozobrome solution (as sold)	4 ozs.
Water	16 ozs.

Making a working bath of 20 ozs.

PROCEDURE.

Place the bromide print face upwards in cold water and sponge the surface to remove air-bells. Let the print remain in this bath until the other operations are completed. Immerse the "pigment plaster" (tissue) face upwards in A, keeping it under the solution. The time of immersion in this bath is of the greatest importance, as the quality of the resulting picture depends upon the absorption by the gelatine of a definite quantity of acid solution. The following time table serves as a guide:

Immersion of Plaster.

	Seconds in Acid Bath.	Seconds in Pigmenting Bath.
For a normal bromide print with a good range of tones	30	.. 90
For a bromide print that is weak and grey	10 to 20	.. 90
For a bromide print that has strong black shadows and harsh contrasts	40 to 60	.. 90

On removing the plaster from the acid bath, allow it to drain thoroughly, and transfer it, face upwards, to the pigmenting bath, B, where it should remain for $1\frac{1}{2}$ minutes. The bromide and tissue are then brought together, left in contact for 15 to 20 minutes, and the tissue developed by No. 1 or No. 2 method.

THE OZOTYPE PROCESS.

Instructions for the Ozotype process were given in the "1907 Almanac," page 1047.

PAGET PRIZE PLATE COMPANY, LTD.

Paget Plates.

(XXXX, "Swift," XXX, and "Special Rapid.")

PYRO-AMMONIA.

P. Pyrogallie acid	1 oz.	50 gms.
Citric acid	60 grs.	7 gms.
Sodium sulphite	2½ ozs.	125 gms.
Distilled water to make ..	20 ozs.	1000 c.c.s.
A. Liq. ammoniæ, 880	1 oz.	50 c.c.s.
Ammonium bromide	120 grs.	14 gms.
Distilled water to make ..	20 ozs.	1000 c.c.s.

Studio Developer.—Dilute 1 part of P with 5 parts of water, and dilute 1 part of A with 5 parts of water. Mix the two dilute solutions in equal quantities for use. (Such developer contains about 2 grs. pyro, 2 minims ammonia, $\frac{1}{2}$ gr. bromide, 5 grs. sulphite, $\frac{1}{2}$ gr. citric acid, in each ounce.) If a thinner and softer negative be desired, use less of P.

PYRO-SODA.

No. 1. Pyrogallie acid	1 oz.	25 gms.
Sulphuric acid	5 minims	10 c.c.
Distilled water to make ..	10 ozs.	1000 c.c.s.
No. 2. Carbonate of soda	2 ozs.	200 gms.
Sulphite of soda	2 ozs.	200 gms.
Potass. bromide	60 grs.	14 gms.
Distilled water to make ..	10 ozs.	1000 c.c.s.

For studio use, 1 part of each and 2 parts of water (making 4 parts altogether) will be found about right. Such developer contains about 3 grs. pyro and 22 grs. each of carbonate and sulphite to each oz.

Paget P.O.P.

Toning—The following bath is strongly recommended in preference to any other:—

Ammonium sulphocyanide	....24 grs.	3.4 gms.
Gold chloride	2 grs.	.28 gms.
Water	16 ozs.	1000 c.c.s.

If it is desired to tone more slowly, a small quantity of sulphite of sodium, say, from $\frac{1}{4}$ to $\frac{1}{2}$ a gr. for each grain of gold used, should be added to the toning bath. This makes the toning much *slower* and *more even*. In professional work, where a large number of prints are toned at once, the addition of sulphite is very useful, as the slower toning gives more time for examination.

For decidedly *warm* tones (really pure light browns and red browns) the following formula is recommended:—

Gold chloride	1 gr.	.15 gms.
Ammonium sulphocyanide ..	8 grs.	11.5 gms.
Sodium sulphite	1 gr.	.15 gm.
Water to make	16 ozs.	1000 c.c.s.

Tone to the desired colour, judging by looking through. Toning is slow, taking from 5 to 10 or 12 minutes. When toned, wash the prints in water, fix and finish as usual.

Developing.

The Paget "partial development" process is given under "Standard Formulae for the Principal Photographic Processes."

Paget Collodion Papers.

COLLODIO-CHLORIDE P.O.P.

Gold Toning.

Ammonium sulphocyanide ..	30 grs.	2 gms.
Gold chloride	2 grs.	.13 gms.
Water	16 ozs.	450 c.c.s.

PLATINOID C.C. PAPER.

A. Gold chloride	15 grs.	2 gms.
Water	15 ozs.	1000 c.c.s.
B. Soda bicarbonate	120 grs.	.16 gms.
Distilled water	15 ozs.	1000 c.c.s.

For use take 1 part A, 1 part B, and 28 parts water. The mixture does not keep; only enough for use should therefore be made up from A and B as required.

Tone prints to a chocolate or reddish purple colour. Wash for five minutes. Then tone again in—

Potass chloroplatinite	15 grs	5 gms.
Dilute phosphoric acid (Acid		
Phosph. dil B P)	3 ozs.	50 c.c.s.
Water to make	60 ozs.	1000 c.c.s.

If a bluer black is desired it may be obtained by using $\frac{1}{2}$ oz. of lactic acid in the second bath instead of 3 ozs phosphoric acid.

The prints should remain in this bath until quite black. They are then washed and fixed as usual.

A very fine brown black may be obtained by the use of the chloroplatinite bath only. In this case the print should be placed, after first washing, in weak ammonia (say $\frac{1}{2}$ oz. liquor ammonia 880 to the pint of water) for a few seconds, then washed again for a minute and toned.

Paget Self-Toning Papers.

COLLODION.

For warm brown tones wash print for 5 minutes and fix in—

Hypo	3 ozs.	150 gms.
Water	20 ozs.	1000 c.c.s.

for 10 minutes; wash thoroughly and dry. If a colder tone be desired, *instead* of first washing, place print in:—

Common salt	2 ozs.	100 gms.
Water	20 ozs.	1000 c.c.s.

for 5 minutes, then rinse in water and fix as above.

Platinum Toning.

A fine olive black tone can be obtained in the following way.—

Potassium chloroplatinite ..	15 grs.	1 gm.
Sodium chloride	150 grs.	10 gms.
Citric acid	150 grs.	10 gms.
Water to make	7 $\frac{1}{2}$ ozs.	220 c.c.s.

For use, take 1 part of stock solution, and 10 parts water.

The prints are first put into a bath of common salt 1 oz., water 10 ozs., for 5 minutes washed, and then placed in the platinum bath and kept constantly moving, until all trace of red has disappeared from the print when it is looked through. This will take from 5 to 10 minutes. Wash again for 5 minutes and fix in the ordinary hypo fixing bath.

GELATINE ("SIMPLEX").

For coldest purple, fix in hypo, 8 oz. in 20 oz., for 6 or 7 minutes.

" warmer "	4 " " "	6 " 7 "
" sepia "	3 to 2 " " "	10 "
" brown or red " ..	1 $\frac{1}{2}$ " $\frac{1}{2}$ " " "	15 "

Fixing should be timed fairly close to above directions, and bath should be about 65° temperature.

"Gravura" (Gaslight) Papers.

FOR BLACK TONES, WITH NO. 1 OR NO. 2 PAPER

Metal	1 oz.	6 gms
Sodium sulphite	8 ozs.	48 gms
Sodium carbonate (cryst)	10 ozs	60 gms
Potass bromide	16 grs.	25 gm.
Water to make	160 ozs	1000 c c.s.
(1 gallon)		

The addition of a few drops of cyanide solution, as advised under "Clearing Prints," is strongly recommended where *glossy* paper is used, or if the paper is at all old. In any case it does no harm to the print and helps to keep it clean.

The above formula gives good gradation and an excellent black tone, but it *cannot* be used for colours. Development is complete in about 10 to 20 seconds.

WARM TONES, WITH NO. 2 PAPER ONLY

II Hydroquinone	1 oz	55 grs	6 gms.
Me:ol	$\frac{1}{2}$ oz	14 grs.	1 5 gm
Sodium sulphite	8 oz	1 oz.	48 gms
Sodium carbonate	10 ozs,	$1\frac{1}{2}$ oz.	60 gms.
Potass bromide	16 grs	2 grs	25 gm
Water to make	160 ozs.	20 ozs.	1000 c c.s.
(1 gallon)			
A.C Ammonium bromide	1 oz		50 gms
Ammonium carbonate	1 oz.		50 gms
Water to make	20 ozs.		1000 c c s.

Development for Colours

Cool to Warm Sepias. Exposure—5 to 6 times Black

Stock solution H.	1 oz.	30 c c s.
Stock solution A. C.	50—60 min.	3—3 5 c c.s.
Water to make	6 c z.	170 c.c.s.

Warm Brown to Red. Exposure—6 to 8 times Black

Stock solution H... .. .	1 oz.	30 c.c.s.
Stock solution A.C.	$\frac{1}{2}$ oz.	7 c.c.s.
Water to make	8 ozs.	230 c.c.s.

Red chalk. Exposure—8 to 10 times black.

Stock solution H... .. .	1 oz.	30 c.c.s.
Stock solution A.C.	$\frac{1}{2}$ oz.	15 c.c.s.
Water to make	20 ozs.	570 c.c.s.

Red development may take 5 minutes or more.

Clearing Solution.

To remove friction marks and improve colour and clearness of prints.

No. 1. Hypo	.. .. .	1 oz.	50 gms.
Water	.. .. .	20 ozs.	1000 c.c.s.
No. 2. Potass ferricyanide (Red prus- siate of potash)	.. .. .	30 grs.	14 gms.
Water	.. .. .	5 ozs.	1000 c.c.s.

For use, add $\frac{1}{2}$ dram of No. 2 to each ounce of No. 1, and lay the print in the mixture, in a clean dish. The marks can then be easily removed by gentle rubbing with a pad of cotton wool. Wash and dry the print as usual.

Surface marks may be to a great extent prevented by adding to each ounce of developer 3 or 4 drops of a 10 per cent. solution of cyanide of potassium.

“Paget” Lantern Plates.

No. 1 Hydroquinone	.. .. .	$\frac{1}{2}$ oz.	25 gms
Sulphurous acid B P	.. .. .	$\frac{1}{4}$ oz	12.5 gms.
Potassium bromide	.. .. .	60 grs	6.8 gms.
Water to	.. .. .	20 ozs	1000 c.c.s
No. 2. Caustic soda	.. .. .	$\frac{1}{2}$ oz.	25 gms.
Sodium sulphite	.. .. .	$2\frac{1}{2}$ ozs	125 gms.
Water to	20 ozs.	1000 c.c.s

For Warm Tones.

No. 3. Bromide of ammonium	.. .. .	1 oz.	50 gms.
Carbonate of ammonium	.. .. .	1 oz.	50 gms.
Water to	.. .. .	20 ozs.	1000 c.c.s.

Carbonate of ammonium should be in clear lumps; if from exposure to the air it has become coated with the white powdery bicarbonate, the latter should be scraped off.

The following table shows how the developer should be used for black and warm tones. The bromide of ammonium which is contained in No. 3 solution restrains the plate from developing too quickly, and the carbonate of ammonium, which also appears to act as a restrainer, assists in producing a much warmer deposit than can be secured by means of the use of the bromide alone. The longer the exposure which is given to the plate, the more of the No. 3 solution *must be used*, and the warmer the resulting slide will be. By following this simple method, a range of tones from black through warm black, brown, purple brown, and purple to red may be secured.

It should be noted that the proportion of the No. 3 solution used determines the *time of development* as well as the colour of the image. The table shows approximately the relative exposures, proportion of No. 3 solution, and time of development;

Relative Time of Exposure.	Constitution of Developer.	Time of Development.	Colour of Deposit.
30 secs. ..	No. 1 .. $\frac{1}{2}$ oz. No. 2 .. $\frac{1}{2}$ oz. Water to make 2 ozs.	2½ to 3 minutes.	Black
One minute ..	No. 1 .. $\frac{1}{2}$ oz. No. 2 .. $\frac{1}{2}$ oz. No. 3 .. 100 minims Water to make 2 ozs.	5 minutes ..	Brown
One and a half minutes ..	No. 1 .. $\frac{1}{2}$ oz. No. 2 .. $\frac{1}{2}$ oz. No. 3 .. 200 minims Water to make 2 ozs.	10 minutes.	Purple brown
Three minutes	No. 1 .. $\frac{1}{2}$ oz. No. 2 .. $\frac{1}{2}$ oz. No. 3 .. 250 minims Water to make 2 ozs.	12 minutes..	Purple
Five minutes	No. 1 .. $\frac{1}{2}$ oz. No. 2 .. $\frac{1}{2}$ oz. No. 3 .. 300 minims Water to make 2 ozs.	15 minutes..	Red

“Gravura” (Gaslight) Lantern Plates.

These are developed with the second (H) formula given above for “Gravura” paper. For warm tones, in every case the water added should be only half the quantity mentioned.

RAJAR, LTD.

Cleron Roll and Flat Films.

A. Potass. metabisulphite .. .	30 grs.	35 gms
Pyro.. ..	$\frac{1}{2}$ oz.	12.5 gms.
Water	20 ozs.	1000 c.c.s
B. Sodium carbonate	2 ozs.	100 gms.
Sodium sulphite	2 ozs.	100 gms.
Potass. bromide	10 grs.	1 gm.
Water	20 ozs.	1000 c.c.s.

For correct exposure, A, 1 part; B, 1 part.

For under-exposure, A, 1 part; B, 2 parts; water, 1 part.

For over-exposure, A, 2 parts; B, 1 part, with 10 to 20 drops 10 per cent. potass. bromide solution per ounce of mixed developer.

"Rajar" P.O.P.

Toning Bath.

Ammonium sulphocyanide	.. 20 grs.	2.3 gms.
Gold chloride	.. .. 2 grs.	.23 gm.
Water	.. .. 20 ozs.	1000 c.c.s.

This bath produces dark brown to purple black tones, but if warm tones are desired it is advisable to dilute the bath with the following solution :-

Sodium sulphite	.. .. 2 grs.	.23 gm.
Water	.. .. 20 ozs.	1000 c.c.s.

"Rajar" C.C. Paper.

Wash and tone in :-

Ammonium sulphocyanide	.. 21 grs.	1.4 gms.
Gold chloride	.. .. 4 grs.	.26 gm.
Water	.. .. 25 oz.	710 c.c.s.

For matt paper, print till shadows bronze, wash and tone in :-

Sodium acetate	.. .. 100 grs.	11.4 gms.
Gold chloride	.. .. 2½ grs.	.28 gms.
Water	.. .. 20 ozs.	1000 c.c.s.

again washing and toning in :-

Citric acid	.. .. 150 grs.	17.1 gms.
Potass. chloroplatinite	.. .. 10 grs.	1.1 gms.
Water	.. .. 20 grs.	1000 c.c.s.

"Rajar" Self-toning P.O.P.

When printed fix in the baths described below, then wash for an hour in water.

Depth of Printing.	Fixing bath. To the pint water.	Time.	Tone.
Very dark (shadows blocked) ..	6 ozs. hypo. ..	6 minutes ..	Purple.
" " (but shadows not so deep)	6 ozs. hypo. ..	6 minutes ..	Purple brown.
Fairly deep	3 ozs. hypo. . .	10 minutes ..	Sepia.
Usual depth	2 ozs. hypo. . .	10 minutes ..	Brown.
" "	1 oz hypo. . .	15 minutes ..	Red brown.

The "Special Portrait" self-toning paper is fixed direct for ten minutes in hypo., 1 oz., water 10 ozs. for sepia tones. For purple black, it is first placed direct in 1:10 salt bath, then treated as before in 1:10 hypo.

"Rajar" Bromide Paper.*Developer*

Metol	..	..	..	8 grs.	9 gm.
Hydroquinone	..	..	..	30 grs.	35 gms.
Sodium sulphite	..	..	..	$\frac{3}{4}$ oz.	37.5 gms.
Sodium carbonate	..	..	..	$\frac{1}{4}$ oz.	37.5 gms.
Potass. bromide	..	..	..	20 grs.	23 gms.
Water	..	..	..	20 ozs.	1000 c.c.

"Rajar" Gaslight Paper.*Developer.*

Potass. metabisulphite	..	..	20 grs.	2.3 gms.
Metol	..	..	16 grs.	1.8 gms.
Hydroquinone	..	..	60 grs.	6.8 gms.
Sodium sulphite	..	..	480 grs.	55 gms.
Sodium carbonate	..	..	800 grs.	91 gms.
Potass. bromide	..	..	2 grs.	.2 gms.
Water	..	..	20 ozs.	1000 c.c.

ROTARY PHOTOGRAPHIC CO., LTD.**"Rotograph" Negative Paper.**

A. Ortol	..	..	..	1 oz.	16.5 gms.
Potass metabisulphite	..	..	..	$\frac{1}{4}$ oz.	8.2 gms.
Water	..	..	..	60 ozs.	1000 c.c.s.
B. Sodium carbonate	..	..	..	12 ozs.	200 gms.
Sodium sulphite	..	..	..	8 ozs.	130 gms.
Water	..	..	..	60 ozs.	1000 c.c.s.

For use take A, 1 part; B, 1 part; water to make 10 parts.

This developer is most suitable when working from harsh transparencies since, like amidol, it tends to softness. The best developer for negative paper is ferrous oxalate or ferrous citrate.

The paper should be fixed in an "acid" bath.

When dry, it is sufficiently transparent to print quickly without further treatment. If, however, great transparency is required, the following mixture should be rubbed into the back of the paper with cotton wool.

Canada balsam	..	..	..	..	1 oz.
Turpentine..	..	..	..	..	5 ozs.

"Roto" P.O.P.

Toning.

A. Sulphocyanide solution	40 grs.	91.2 gms
Water	1 oz.	1000 c.c.s.
B. Gold chloride	15 grs.	17.0 gms.
Water	15 drms.	1000 c.c.s.

For purple tones, A, 3 drams; water, 20 ozs.; B, 1½ drams. For warm brown tones, A, 2 drams; sodium sulphite, 1 gr; water, 20 ozs.; B, 1 dram.

FOR MATT P.O.P.

Sodium acetate	60 grs.	4 gms.
Borax	80 grs.	5.2 gms.
Gold chloride	2 grs.	.13 gms.
Water to make	35 ozs	1000 c.c.s.

"Rotary" Collodio-Chloride P.O.P.

Toning Baths for the Matt Paper.

Sodium acetate	96 grs	2 gms.
Chloride of gold	2½ grs.	5 c.c.s. of 1% solution.
Distilled water	20 ozs	200 c.c.s.

Make this bath up several hours before use.

The prints should be toned in this bath only until they commence to change colour. Then wash thoroughly for a few minutes and place in -

Potassium chloroplatinite ..	12 grs.	1 gm.
Citric acid, pure	180 grs.	15 gms.
Distilled water	20 ozs.	800 c.c.s.

Make this bath up about an hour before use.

In this bath the prints should remain till the desired tone is attained. The tone passes from red to brown, brownish-black, blue-black to pure black.

Very fine warm and permanent tones, somewhat similar to platinum prints, may be obtained merely by use of the above platinum bath, without the preliminary gold bath.

Red, sepia, and violent tones can be obtained by short or long toning with the gold bath alone.

Toning Bath for the Glossy Paper.

After washing, the prints should be immersed in the following toning bath:—

Sodium acetate (fused)	530 grs.	5.5 gms.
Ammonium sulphocyanide	48 grs.	.5 gm.
Distilled water	20 ozs.	100 c.c.s.
Chloride of gold	½-¾ gr.	6 to 8 c.c.c. of 1% solution.

Make this bath up several hours before use.

Tone to any point the finished prints are required to be, wash, fix and wash.

“Rotona” P.O.P.

Prints are fixed for not less than 8 minutes in 10 per cent. hypo containing a little bicarbonate of soda.

For colder tones, use stronger hypo solution, up to 30 per cent., or without preliminary rinse, place prints in a solution of ordinary salt (2 ozs. of salt to 20 ozs. of water) for 3 to 5 minutes, then fix and complete the print in 10 per cent. hypo as given above for warm tones.

Considerable variation of tones is obtainable by altering the strength of salt and hypo, whether for cold or warm tones, but the above quantities are the minimum to be used for yielding permanent results.

“Rotograph” Bromide Papers.

Metol-Hydroquinone Developer

Metol	..	..	..	50 grs.	5.7 gms.
Hydroquinone	..	..	..	40 grs.	4.6 gms.
Sodium sulphite	..	..	..	500 grs.	57 gms.
Potass bromide	..	..	..	25 grs.	2.9 gms.
Sodium carbonate	..	..	..	500 grs.	57 gms.
Water (distilled or boiled) to	..	..	..	20 ozs.	1000 c.c.s.

Amidol Developer.

Sodium sulphite	..	..	..	200 grs.	23 gms.
Potass bromide	..	..	..	1 gr.	.1 gm.
Amidol	..	..	..	20 grs.	.7 gms.
Water to	..	..	..	6 ozs.	1000 c.c.s.

Dilute 1 part of the above with 4 parts of water, and apply to the paper; as soon as the shadows have developed pour off, and apply the strong solution till sufficient density is obtained; then pour off, wash well, and fix. This method gives rich blacks with brilliant whites.

“Rotox” (Gaslight) Paper.

Rodinal Developer.

Rodinal	..	..	..	1 oz.	50 c.c.s.
Water	..	..	..	20 ozs.	1000 c.c.s.
Potass bromide (10% solution)	..	..	..	25 minims	3 c.c.s.

Metol-Hydroquinone.

Sodium carbonate	..	..	..	2½ ozs.	125 gms.
Sodium sulphite	..	..	..	1 oz.	50 gms.
Metol	..	..	..	16 grs.	1.8 gm.
Hydroquinone	..	..	..	55 grs.	6.3 gms.
Potass bromide	..	..	..	3 grs.	.35 gm.
Water	..	..	..	20 ozs.	1000 c.c.s.

Development takes place very quickly. If correctly exposed, the print attains full density in 5 to 10 seconds.

“Rotary” Carbon Tissues and Stripping Films.

For Monochrome and Three-Colour Work.

SENSITISING BATH.

Sensitise by immersion for 1 or 2 minutes in the following bath.—

Potass bichromate	.. ..	1 oz	30 gms
Water	.. ..	30 ozs.	900 c.c.s.
Ammonia (880)	.. ..	1 drachm	3·5 c.c.s

The bath must be neutralised by ammonia as in the above formula, as, if left acid, the keeping properties of the sensitised tissues are greatly affected. The bath can be used several times, being stored in the dark. If it takes a brownish tint it must be discarded for a fresh one.

Stronger bichromate baths give a more sensitive tissue than weak ones. A tissue sensitised in a 4 per cent bath is four times as sensitive as one treated in a bath of 1 per cent. The strength of the bath likewise affects the character of the print, negatives of great contrasts requiring stronger baths, and those tending to flatness weaker baths. The temperature of the bath should not rise above 62 degrees F, otherwise the film of pigment and gelatine is softened, and may even dissolve in certain circumstances.

QUICK-DRYING SENSITISER.

Ammonium bichromate	.. ..	$\frac{1}{2}$ oz.	15 gms.
Water	$3\frac{1}{2}$ ozs.	100 c.c.s

Dissolve and add—

Alcohol (rect spirit)	$3\frac{1}{2}$ ozs	100 c.c.s.
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It is advisable to use hot water for this, or the salt will not dissolve. As soon as the solution is cooled down somewhat the rectified spirit may be added. To apply this sensitiser, the films should be pinned down to a stout cardboard, and the solution painted on with a soft brush well charged with the solution, and kept on the move up and down and across until the film is thoroughly saturated and the solution swimming on the surface. The surplus should be then blotted off with clean blotting paper, and the film put away to dry.

CEMENTING SOLUTION FOR THREE-COLOUR PRINTS.

Ordinary gelatine..	.. ..	150 grs.	10 gms.
Warm water	.. ..	30 ozs.	900 c.c.s.
After complete solution, add—			
Chrome alum (10 % solution)	.. ..	$\frac{1}{2}$ oz.	20 c.c.s.
Stirring well and filtering.			

E. J. Wall's Method.

Gelatine	.. ..	150 grs.	10 gms.
Glacial acetic acid	.. ..	150 minims.	10 c.c.s.
Distilled water	.. ..	$8\frac{1}{2}$ ozs.	240 c.c.s.

Allow to soak for a short time, then heat in a water bath to 150 deg. Fahr., and add slowly and with constant stirring:—

Methylated spirit..	26 ozs.	750 c.c.s.
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If this is carefully done, no gelatine will be thrown out, or at least, it will not remain out of solution, though just at first it may come out as milky white threads. This solution keeps well, but must be heated before use. It is painted freely over the print, and the latter left for a few minutes till the best part of the spirit has evaporated and the surface has become tacky. The next image, which is allowed to drain well and has begun to get surface dry, is lowered into position.

THE CARBOGRAPH PROCESS.

For this process of pigment printing and enlarging direct see under "Epitome of Progress."

W. W. ROUGH AND CO.

Developer Stock Solutions.

A. Pyro.. ..	1 oz.	100 gms.
Sodium sulphite ..	4 ozs.	400 gms.
Water to make ..	10 ozs.	1000 c.c.s.

Dissolve the sulphite of soda in hot water, and, when cold, add the pyrogallie acid.

B. Ammonium bromide ..	1 oz.	100 gms.
Water to make ..	10 ozs.	1000 c.c.s.
C. Liquor ammonia (830) ..	3 ozs.	300 c.c.s.
Water to make ..	10 ozs.	1000 c.c.s.

R. W. THOMAS & CO., LTD.

Thomas's Lantern Plates.

For Black and Warm Tones.

No. 1. Hydroquinine ..	160 grs.	10 gms.
Sodium sulphite ..	2 ozs.	60 gms.
Citric acid ..	60 grs.	4 gms.
Potassium bromide ..	40 grs.	2½ gms.
Water to ..	20 ozs.	600 c.c.s.
No. 2. Sodium hydrate ..	160 grs.	10 gms.
Water to ..	20 ozs.	600 c.c.s.
No. 3. Ammonium bromide ..	2 ozs.	60 gms.
Water to ..	20 ozs.	600 c.c.s.
No. 4. Ammonium carbonate ..	2 ozs.	60 gms.
Water to ..	20 ozs.	600 c.c.s.

For Black Tones.			
No. 1	..	$\frac{1}{2}$ oz.	15 c.c.s.
No. 2	..	$\frac{1}{2}$ oz.	15 c.c.s.
Water to	..	2 ozs.	60 c.c.s.

For Purple Tones.			
No. 1	..	$\frac{1}{2}$ oz.	15 c.c.s.
No. 2	..	$\frac{1}{2}$ oz.	15 c.c.s.
No. 3	..	30 minims	2 c.c.s.
No. 4	..	30 minims	2 c.c.s.
Water to	..	2 ozs.	60 c.c.s.

For Brown Tones.			
No. 1	..	$\frac{1}{2}$ oz.	15 c.c.s.
No. 2	..	$\frac{1}{2}$ oz.	15 c.c.s.
No. 3	..	15 minims	1 c.c.
No. 4	..	15 minims	1 c.c.
Water to	..	2 ozs.	60 c.c.s.

For Red Tones.			
No. 1	..	$\frac{1}{2}$ oz.	15 c.c.s.
No. 2	..	$\frac{1}{2}$ oz.	15 c.c.s.
No. 3	..	90 minims	6 c.c.s.
No. 4	..	90 minims	6 c.c.s.
Water to	..	2 ozs.	60 c.c.s.

The relative times of exposure and development for these tones are--

	Black.	Brown.	Purple.	Red.
Exposure	.. 30 secs. at 24 in.	30 secs. at 6 in.	30 secs. at 5 in.	60 secs. at 5 in.
Development	.. 4 minutes	10 minutes	18 minutes	30 minutes

WARWICK DRY PLATE CO.

("Special Rapid," "Double Instantaneous," "Rainbow,"
and "Warpress" plates.)

A. Pyro	..	..	..	1 oz.	12.5 gms.
Nitric acid	..	..	..	20 drops	10 drops.
Water	..	..	..	80 ozs.	1000 c.c.s.
B. Soda sulphite	..	..	..	10 ozs.	112.5 gms.
Soda carbonate, crystal	..	..	..	9 ozs.	125 gms.
Water	..	..	..	80 ozs.	1000 c.c.s.

For use, take equal parts of A and B.

HYDROQUINONE.

No. 1. Water	..	..	..	20 ozs.	1000 c.c.s.
Hydroquinone	..	..	..	120 grs.	14 gms.
Sodium sulphite	..	..	..	2 ozs.	100 gms.
No. 2. Water	..	..	..	20 ozs.	1000 c.c.s.
Potass carbonate	..	..	..	4 oz.	200 gms.
Potass bromide	..	..	..	30 grs.	3.5 gms.

For use take equal parts of each.

WELLINGTON AND WARD.

Wellington Plates.

("Speedy," "Iso Speedy," and "Landscape")

Pyro-Ammonia Developer

No. 1.	Pyrogallie acid	1 oz.	100 gms.
	Sodium sulphite	2 ozs.	200 gms.
	Citric acid.. ..	40 grs.	9.2 gms.
	Water to	10 ozs.	1000 c.c.s.
No. 2.	Ammonia (.980)	1 oz.	100 c.c.s.
	Water to	10 ozs.	1000 c.c.s.
No. 3.	Ammonium bromide	1 oz.	100 gms.
	Water to	10 ozs.	1000 c.c.s.

Take 10 minims (2 c.c.s.) of No. 1, 10 minims of No. 2, and 5 minims (1 c.c.) of No. 3 to each ounce (100 c.c.s.) of water.

Pyro-Soda Developer

No. 1.	Pyrogallie acid	1 oz.	100 gms.
	Sodium sulphite	2 ozs.	200 gms.
	Citric acid.. ..	40 grs.	9.2 gms.
	Water to	10 ozs.	1000 c.c.s.
No. 2.	Sodium carb nate	8 ozs.	100 gms.
	Sodium sulphite	8 ozs.	100 gms.
	Water to	80 ozs.	1000 c.c.s.

Normal Work —Take 1 oz. of No. 2 and 1 dr. of No. 1, with water 1 oz.

Studio Work —Take 1 oz. of No. 2 and $\frac{1}{2}$ dr. of No. 1, with water 1 oz. •

"Wellington" Roll-Films.

• The above pyro-soda developer is used for the films, using No. 1, 1 drachm; No. 2, 1 oz.; water, 1 oz.

For over-exposed negatives, add 10 to 20 drops of the following, in 4 ozs of developer, according to amount of over-exposure:—

Potass bromide	1 oz.	10 gms.
Water	10 ozs.	100 c.c.s.

This restrainer is to be used only in case of over-exposure.

Wellington "Ortho Process" Plates.

Hydroquinone Developer.

Hydroquinone	80 grs.	9.1 gms.
Sodium sulphite	1 oz.	50 gms.
Potass hydrate	80 grs.	9.1 gms.
Ammonium bromide	10 grs.	1.1 gm.
Water	20 ozs.	1000 c.c.s.

Pyro-Soda.

No. 1.	Pyrogallie acid ..	..	1 oz.	100 gms.
	Sodium sulphite ..	..	2 ozs.	200 gms.
	Citric acid ..	..	40 grs.	9.1 gms.
	Water to ..	..	10 ozs.	1000 c.c.s.
No. 2.	Sodium carbonate ..	..	8 ozs.	100 gms.
	Sodium sulphite ..	..	8 ozs.	100 gms.
	Potass bromide ..	..	40 grs.	1.1 gm.
	Water to ..	..	80 ozs.	1000 c.c.s.

No. 1, 1 drachm; No. 2, 1 oz.

Wellington "Watalu" Plates.

(*Self-developing.*)

"DEVELOPER."

For a quarter-plate ..	..	..	1 oz. of water
For a half-plate ..	..	..	2 ozs. of water
For a whole-plate ..	..	..	4 ozs. of water

For normal exposure it is best to have the water at a temperature of 60 deg. Fahr. Gently rock the dish for the first minute or two, in order to assist the soluble backing to dissolve.

For under-exposure add three to four times the original quantity of water, raise the temperature of same to 70 deg. Fahr., and continue development for 15 minutes.

"Wellington" Ordinary P.O.P.*Formate Toning Bath.*

Sodium formate ..	..	15 grs.	.85 gm.
Sodium bicarbonate ..	..	3 grs.	.17 gm.
Gold chloride ..	..	2 grs.	.11 gm.
Water (distilled) ..	..	40 ozs.	1000 c.c.s.

The bath is ready for use as soon as made up; it will not keep.

Phosphate Toning Bath.

Phosphate of soda	60 grs.	3.4 gms.
Gold chloride ..	..	2 grs.	.11 gm.
Water ..	..	40 ozs.	1000 c.c.s.

This bath should be allowed to stand one hour before using; it will not keep. The above quantity is sufficient for 24 half-plates.

"Wellington" Special and Carbon P.O.P.

Well wash the prints previous to immersion in the toning bath.

Ammonium sulphocyanide ..	..	20 grs.	2.8 gms.
Gold chloride ..	..	2 grs.	.3 gm.
Water ..	..	16 ozs.	1000 c.c.s.

The tone is to be entirely judged by the surface, and not by looking through the print. Always undertone, as the finished print becomes very much colder when dry.

"Wellington" Self-Toning Paper.

Immerse prints direct, without washing, in the following —

Hypo-sulphite of soda	..	..	6 ozs.	300 gms.
Water	..	..	20 ozs.	1000 c.c.s.

The fixing bath should be rendered alkaline by the addition of 30 grains (3.5 gms.) of bicarbonate of soda, which prevents sulphur toning and ensures greater permanency of the print.

Fix until desired tone is reached, which should not be less than eight minutes; then wash thoroughly, from half to one hour in running water if possible, or frequent changes.

"Wellington" Bromide Papers.

Amidol is recommended as the most reliable developer for general purposes, although any other may be used.

Amidol	..	..	50 grs.	5.7 gms.
Sulphite soda	..	..	650 grs.	74 gms.
Potass bromide	..	..	10 grs.	1.1 gm.
Water	..	..	20 ozs.	1000 c.c.s.

This developer should be used within three days of mixing.

It is often recommended to keep a stock solution of sodium sulphite by itself, and to take some of this when wanted and add the amidol to it. *Experience shows that this will not do*, as amidol when used with stale sulphite solution develops very slowly, and there is a great loss of brilliancy in the resulting prints. The developer given above should therefore be mixed up as directed, and used within three days of mixing.

Metol-Hydroquinone Developer.

Metol	..	..	50 grs.	6 gms.
Hydroquinone	..	..	15 grs.	1.7 gm.
Sulphite of soda	..	..	500 grs.	57 gms.
Potass bromide	..	..	10 grs.	1.1 gm.
Potass carbonate	..	..	100 grs.	11 gms.
Water	..	..	20 ozs.	1000 c.c.s.

Dissolve the metol in the water first.

CLEARING AND REDUCING BROMIDE PRINTS.

In clearing up and brightening up a bromide print, removing surface markings or yellow stains or slight fog, the following bath will be found of great service. It should be applied after fixing and washing, the prints being left in until the desired clearing has taken place, and then removed and well washed. —

Thiocarbamide	..	..	20 grs.	4.6 gms.
Citric acid	..	..	10 grs.	2.3 gms.
Water	..	..	10 ozs.	1000 c.c.s.

This bath will not work unless all traces of hypo have been removed from the print.

BRIGHT PRINTS FROM VERY WEAK NEGATIVES.

The following method will be found to give bright vigorous prints from flat negatives when every other means has failed :—

Expose the bromide paper in the usual way, developing it as long as any increase in depth is seen to be gained, ignoring altogether the discolouration of the high-lights—over-develop it, in fact. After fixing and washing, pour over it the following reducing solution until it is seen to be considerably lighter; when it is, at once plunge into clean hypo for a few minutes. If it is not yet light enough it may be again washed, treated with reducer, and fixed. When it is seen that any further reduction will render the blacks grey, it is washed and dried. Many a negative otherwise quite useless may in this way be saved :—

Potassium iodide	..	..	30 grs.	6 8 gms.
Water	..	..	10 ozs.	1000 c.c.s.
Iodine	..	..	3 grs.	7 gms.

With this bath the whites of the print will assume a dark blue tint, owing to the formation of iodide of starch due to the sizing of the paper; this immediately vanishes upon placing in the hypo solution

“Wellington” S.C.P.

Slow Contact Paper.

Metol	..	..	10 grs.	2.3 gms.
Hydroquinone	..	..	30 grs.	6.8 gms.
Sulphite of soda (cryst.)	..	..	350 grs.	80 gms.
Carbonate of soda (cryst.)	..	..	350 grs.	80 gms.
Bromide of potassium	..	..	3 grs.	7 gm.
Water	..	..	10 ozs.	1000 c.c.s.

Dissolve the above in the order named.

For very brilliant blue-black tones a suitable developer is :—

Sulphite of soda	..	..	500 grs.	114 gms.
Amidol	..	..	50 grs.	11.4 gms.
Bromide of potassium	..	..	2 grs.	46 gm.
Water	..	..	10 ozs.	1000 c.c.s.

This developer only keeps three days; after that time it should be discarded and fresh made up.

“Wellington” Lantern Plates.

Developer for Cold Tones.

Hydroquinone	..	..	80 grs.	9.2 gms.
Sulphite of soda	..	..	1 oz.	100 gms.
Potass hydrate	..	..	80 grs.	9.2 gms.
Ammonium bromide	..	..	10 grs.	1 gm.
Water	20 ozs.	1000 c.c.s.

Developer for Warm Black Tones.

Three stock solutions are prepared as given above for "Speedy" plates. These are used as follows:—Take 30 minims of No. 1, 60 minims of No. 2, and 30 minims of No. 3, with water, 1 oz.

For warm black tones. Time of development, two minutes.

For warmer tones, increase the exposure four to six times, also increasing No. 3 up to 90 minims. Time of development, five to six minutes.

"Wellington" S.C.P. Lantern Plates.*Developer.*

A. Metol	..	..	..	20 grs.	2.3 gms.
Sodium sulphite	..	..	..	200 grs.	23 gms.
Sodium carbonate	..	..	..	800 grs.	91 gms.
Hydroquinone	..	..	..	20 grs.	2.3 gms.
Potass bromide	..	..	..	20 grs.	2.3 gms.
Water	20 ozs.	1000 c.c.s.

Warm Tones.

Increase of the bromide up to 20 grs. per ounce of developer gives very pleasing warm tones.

B. Ammonium carbonate	..	..	1 oz.	10 gms.
Ammonium bromide	..	..	1 oz.	10 gms.
Water	..	..	10 grs.	100 c.c.s.

For warm brown to sepia tones, take A, 1 oz. B, 1 drachm.

For very warm reddish tones, take A, 1 oz.; B, 2 drachms.

WRATTEN & WAINWRIGHT, LTD.**Wratten Plates.****TEN PER CENT. PYRO AND AMMONIA.**

A. Liquor ammonia	..	..	1 oz.	100 c.c.s.
Potass bromide	..	..	100 grs.	21 gms.
Water	..	..	10 ozs.	1000 c.c.s.
B. Pyro	..	..	1 oz.	100 gms.
Citric acid	..	..	60 grs.	12 gms.

Or—

* Sulphuric acid	..	..	1 dram	6 c.c.s.
Water	..	..	10 ozs.	1000 c.c.s.

For use with "I.D.S." and "Speed" Plates, the bromide in solution A should read—

Potass bromide	110 grs.	22 gms.
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For instantaneous and ordinary take from 60 (3 c.c.s.) to 90 minims (5 c.c.s.), and for "I.D.S." and "Speed" plates 90 minims (5 c.c.s.) of solution B, dilute with from 2 to 4 ozs. (60 to 120 c.c.s.) of water, and add 100 minims (6 c.c.s.) of solution A.

It is better to add solution A by instalments as development proceeds, unless the exposure is known to be either insufficient or quite accurate, in which cases it may be in one quantity.

PYRO-SODA.

We recommend this developer for studio and hand camera work.

No. 1.	Sodium sulphite	6 ozs.	75 gms.
	Water	80 ozs.	1000 c.c.s.
	Sulphuric acid	1 dram	1.5 c.c.
	Pyro	1 oz.	13 gms.
No. 2.	Sodium carbonate	6 ozs.	75 gms.
	Water	80 ozs.	1000 c.c.s.

For use, take equal parts of Nos. 1 and 2.

For denser negatives use the following more concentrated developer:—

No. 3.	Sodium sulphite	6 ozs.	100 gms.
	Water	60 ozs.	1000 c.c.s.
	Sulphuric acid	1 dram	2 c.c.s.
	Pyro	1 oz.	17 gms.
No. 4.	Sodium carbonate	6 ozs.	100 gms.
	Water	60 ozs.	1000 c.c.s.

Take equal parts of Nos. 3 and 4.

METOL-HYDROQUINONE DEVELOPER.

For *Verichrome*, "Allochome," "Wratten Panchromatic," and
"Bathed" Plates

Metol	44 grs.	10 gms.
Hydroquinone	22 grs.	5 gms.
Sodium sulphite	1 oz.	100 gms.
Sodium carbonate	1 oz.	100 gms.
Water	60 ozs.	6000 c.c.s.

For Process and X Ray Plates.

A.	Hydroquinone	1 oz.	25 gms.
	Potass metabisulphite	1 oz.	25 gms.
	Potass bromide	1 oz.	25 gms.
	Water	40 ozs.	1000 c.c.s.
B.	Caustic potash, pure	2 ozs.	50 gms.
	Water	40 ozs.	1000 c.c.s.

Use equal parts of A and B, and develop for three minutes.

CHAS. ZIMMERMANN & CO., LTD.

"Agfa" Isolar Plates.

Rodinal Developer

In cases of normal exposure develop with---

Rodinal	..	..	..	..	..	..	1 part
Water ..	..	..	..	..	..	..	20 parts

In cases of over-exposure with---

Rodinal	..	..	..	..	..	..	1 part
Water ..	..	..	..	..	..	..	10-20 parts

(adding an ample quantity of solution of potassium bromide, 1: 10), and in case of under-exposure use---

Rodinal	..	..	..	..	..	..	1 part
Water ..	..	..	..	..	..	..	20-40 parts

If development has been performed with an alkaline developer, such as rodinal, eikonogen, metol, pyro, etc., the negative will be quite clear after fixing; but should ferrous oxalate or amidol have been used, there will in all probability be a red colouring of the gelatine, in which case, after fixing, give the plate a five minutes' wash and transfer to a bath of soda carb. 10 per cent. for seven minutes, wash again and replace in the acid fixing bath for ten minutes, and then wash as usual.

When being subsequently intensified or reduced the red colour may reappear, especially when mercury intensification is being employed. In such a case immerse the plate in a 10 per cent. soda carb solution for seven minutes, and then wash until the colour has gone (about one hour).

"Agfa" Chromo Plates.

Metol-Hydroquinone Developer.

Water	..	..	..	..	31½ ozs.	1000 c.c.s.
Metol	..	..	..	..	15 grs.	5 gms.
Hydroquinone	..	..	..	..	23 grs.	75 gms.
Sodium sulphite	..	..	..	..	3½ ozs.	100 gms.
Potass carbonate	..	..	..	..	½ oz.	20 gms.
Potass bromide	..	..	..	..	3 grs.	1 gm.

For a somewhat softer-working developer, giving fine harmonious gradation, it is advisable to employ the well-known rodinal, which for normal exposures should be diluted with 20 parts of water.

After vigorous washing fix in an acid fixing bath, such as the "Agfa" fixing salts.

“Crossed Swords” P.O.P.

For Carbon Red Tones.

Water	..	..	..	..	19 ozs	1000 c.c.s
Borax	..	..	..	..	41 grs.	5 gms.
Chloride of gold	..	..	..	..	1 gr	12 gm.

Must be made up two hours before use, but does not keep well.

Print to about required colour, not too deeply, wash in three changes of water, immerse in:—water 20 ozs., salt 2 drams, until the print has turned orange yellow. Wash once and then tone. When a very slightly lighter colour than desired is obtained, replace in the salt solution for five minutes, rinse and fix in —hypo 2 ozs, water 40 ozs., freshly made.

Carbon Purple and Violet Tones

Water	..	..	..	..	9 ozs	250 c.c.s.
Hydrochloric acid..	..	..	..	..	3 ozs.	85 c.c.s.
Gold chloride	..	..	..	..	3 grs.	2 gm

Print very deeply, wash thoroughly, and tone until desired colour is reached. Wash again and fix in:—hypo 2 ozs, water 40 ozs.

Less acid gives bluish violet. More acid gives red violet—purple.

Toning may be stopped at any stage

Black Tones.

Wash prints in four changes of water before toning and place in:—

Potass chloroplatinite	..	..	..	..	15 grs.	1 gm.
Phosphoric acid (P.B. dil)	..	..	..	..	5 drms.	18 c.c.s.
Distilled water	..	..	..	..	35 ozs.	1000 c.c.s.

When the pictures have assumed the desired black tone they are to be fixed in 5 per cent. hypo for ten minutes, and washed for half an hour in running water. These prints must not be washed before toning in the same bath as any other paper, and when removed from the final washing water should be blotted off.

“Agfa” Isolator Lantern Plates.

*Rodinal Developer.**

Rodinal	..	..	..	..	..	..	1 part
Water	..	..	..	..	..	..	30—40 parts

Fix in an acid fixing bath.

The fixed picture will usually be found to have a slight coloration, which must be removed by the following operation:—Thoroughly rinse the plate after fixing, and immerse in soda carbonate 10 per cent. solution for five minutes. The colour will increase in this bath, but disappear entirely after a further wash and immersion in the acid fixing bath, after which wash as usual and then dry.

Matt-Albumat.*Gold, Platinum, and Gold-Platinum Toning.*

Sodium acetate	..	..	..	22 grs.	2.5 gms.
Soda carbonate	..	..	..	4½ grs.	.5 gms.
Gold chloride	..	..	..	1 gr.	.11 gms.
Water	..	..	..	20 ozs.	1000 c.c.s.

Gives a range of tones from brown to blue-black. Time of toning from ½ to 5 minutes.

Potass chloroplatinite	..	..	..	15 grs.	1.1 gms.
Phosphoric acid (S.G. 1.120)	..	..	..	½ oz.	16.5 c.c.s.
Water	..	..	..	30 ozs.	1000 c.c.s.

Used alone, after washing, gives range of tones from brown to black. Best used fresh.

For gold-platinum tones, prints are placed in gold bath for one second only, quickly washed and placed in platinum bath

DEVELOPING "ALBUMAT."

A. Metol (Agfa)	..	..	..	½ oz.	2 gms
Soda sulphite	..	..	..	4½ ozs.	19 gms.
Citric acid	¼ oz.	1 gm.
Water	25 ozs.	100 c.c.s.

When dissolved add :—

Absolute alcohol	5 ozs.	20 c.c.s.
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Keeps well in corked bottle. One part is diluted with six parts of water for use. Four ounces of diluted solution suffices for sixteen cabinets.

Prints usually require toning with gold or platinum as above; the developer must be thoroughly washed out before toning.

MISCELLANEOUS INFORMATION.

List of the Principal Works on Photography.

[The books mentioned below are obtainable by order of all photographic dealers.]

ELEMENTARY AND GENERAL TEXT-BOOKS.

- Burton's Modern Photography.* By W. K. Burton. 1s.
Elementary Photography By John A. Hodges. 1s.
Ilford Manual of Photography. By C. H. Bothamley, F.C.S. 1s.
Barnet Book of Photography 1s. 6d.
Early Work in Photography. By W. Ethelbert Henry, C E 1s.
Hand-Camera Photography. By Walter Kilbey. 1s.
Photography in a Nutshell. By the Kernel. 1s.
The Figures, Facts and Formulae of Photography. ("The Photographic Annual.") By H. Snowden Ward 1s.
Photographic Reference Book By J. McIntosh. 1s. 6d.
The Science and Practice of Photography. By Chapman Jones. 5s.
Instruction in Photography. By Sir William Abney. 11th Edition. Revised and enlarged. 7s. 6d.
Dictionary of Photography By E. J. Wall. 7s. 6d.
Photography: Its History, Processes, Apparatus and Materials. By A. Brothers. 21s.
The Book of Photography. By Paul N. Hasluck. 10s. 6d.
The Complete Photographer. By R. Child Bayley. 10s. 6d.

PHOTOGRAPHIC OPTICS AND CHEMISTRY.

- Optics for Photographers.* By W. K. Burton. 1s.
Photographic Lenses: How to Choose and How to Use. By John A. Hodges. 2s.
Photographic Lenses. By Conrad Beck and Herbert Andrews. 1s.
The Lens. By Thos. Bolas and George E. Brown. 2s. 6d.
The Optics of Photography and Photographic Lenses. By J. Traill Taylor. 3s. 6d.

- System of Applied Optics.* By H. Dennis Taylor. 30s.
Photographic Optics, a Treatise on. By R. S. Cole. 6s.
Photographic Optics. By Otto Lummer. Translated by Silvanus Thompson. 6s.
First Book of the Lens. By C. Welborne Piper. 2s. 6d.
Telephotography. By T. R. Dallmeyer. 21s.
Elementary Telephotography. By Ernest Marriage. 3s. 6d.
Telephoto Work. By G. H. Deller. 1s.
Lens work for Amateurs. By Henry Orford. 3s.
Tables of Conjugate Foci. By J. R. Gotz. 6d.
Action of Light in Photography By Sir William Abney. 3s. 6d.
Chemistry for Photographers. By Charles F. Townsend, F.C.S. 1s.
The Chemistry of Photography. By R. Meldola. 6s.
Investigations on the Photographic Processes. By S. E. Sheppard, D.Sc., and C. E. Kenneth Mees, D.Sc. 6s. 6d.

ART, PORTRAITURE, HAND-CAMERA WORK, ETC.

- Naturalistic Photography.* By Dr. P. H. Emerson. 5s.
Picture-making by Photography By H. P. Robinson. 2s. 6d.
Art Photography. By H. P. Robinson. 1s.
Photography on Tour. 6d.
Practical Landscape Photography. By G. T. Harris. 1s.
The Photographic Studio. A guide to its construction, etc. By T. Bolas. 2s.
Artistic Lighting. By James Inglis 2s. 6d.
The Lighting in Photographic Studios. By P. C. Duchochois.
 Revised, with additional matter, by W. Ethelbert Henry, C.E. 1s.
Magnesium Light Photography. By F. J. Mortimer. 1s.
Instantaneous Photography. By Sir William Abney. 1s.
Advanced Hand-Camera Work and Focal-Plane Photography. By W. Kilbey. 1s.
Stereoscope and Stereoscopic Photography. From the French of F. Drouin. 2s.
Photo-micography. By E. J. Spitta. 12s.
Practical Photo-micography. By Andrew Pringlo. 3s. 6d.

NEGATIVE PROCESSES.

- Wet-collodion Photography.* By Charles W. Gamble. 1s.
Collodion Emulsion. By H. O. Klein. 5s.
The Wet Collodion Process. By Arthur Payne. 3s.
Practical Orthochromatic Photography. By Arthur Payne. 1s.
Negative-making. By Sir William Abney, F.R.S. 1s.
The Watkins' Manual (of exposure and development). By Alfred Watkins 1s.
Photography by Rule By J. Sterry. 1s.
Finishing the Negative. By George E. Brown. 1s.
Retouching. By Arthur Whiting. 1s.
Art of Retouching. By J. Hubert. 1s.
Art of Retouching Negatives, and Finishing and Colouring Photographs. By Robert Johnson. 2s.

PRINTING PROCESSES.

Photographic and Photo-mechanical Printing Processes. By W. K. Burton. 4s.

Art and Practice of Silver Printing. By Sir William Abney and Robinson. 2s. 6d.

Bromide Enlarging and Contact Printing. By S. Herbert Fry. 6d.

Toning Bromide Prints. By R. Blake-Smith. 1s.

Toning Bromides. By C. W. Somerville. 1s.

Photographic Enlargements: How to Make Them. By Geo. Wheeler. 1s.

Practical Photographic Enlarging. By John A. Hodges. 1s.

A B C Guide to Autotype Permanent Photography. By J. R. Sawyer. 1s.

Carbon Printing. By E. J. Wall. 1s.

Photo-aquatint, or Gum Bichromate Process. By Alfred Maskell and R. Demachy. 1s.

Ozotype. By Thos Manby. 1s.

Ferric and Heliographic Processes. By George E. Brown. 2s.

Photographic Reproduction Processes. By P. C. Duchochois. A treatise on photographic impressions without silver salts. 2s. 6d.

Photo-ceramics. By W. Ethelbert Henry, C.E., and H. Snowden Ward. 1s.

Enamelling and Retouching. By Piquepe. 2s. 6d.

The Photographic Picture Postcard. By E. J. Wall and H. Snowden Ward. 1s.

LANTERNS AND LANTERN SLIDES.

Modern Magic Lanterns. By R. Child Bayley. 1s.

The Lantern, and How to Use It. By Goodwin Norton. 1s.

Optical Projection. By Lewis Wright. 6s.

The Optical Lantern: for Instruction and Amusement. By Andrew Pringle. 2s. 6d.

Lantern Slide Making. By Rev. F. J. Lambert. 1s.

Lantern Slides, How to Make. By S. L. Coulthurst and Geo. E. Brown. 1s.

Living Pictures. By H. V. Hopwood. 2s. 6d.

Animated Photography. By Cecil M. Hepworth. 1s.

PHOTO-MECHANICAL PROCESSES, ETC.

Practical Collotype. By W. W. Fithian. 2s. 6d.

Half-tone Process on the American Basis. By Wm. Cronenberg. 2s.

A Treatise on Photogravure in Intaglio. By the Talbot Klic process. By Herbert Denton. 4s. 6d.

Photo-Mechanical Processes. By W. T. Wilkinson. 4s.

Photo-aquatint and Photogravure. By Thomas Huson. 2s.

Professional Photography. By C. H. Hewitt. Vol. I., 1s. Vol. II., 1s.

Photography for the Press. By the Editors of *The Photographic Monthly*. 1s.

Practical Radiography. A handbook of the applications of the X-rays. By A. W. Isenthal and H. Snowden Ward. 6s.

COLOUR PHOTOGRAPHY.

Photography in Colours. By Bolas, Tallent and Senior. 5s.

Three-colour Photography. By Baron von Hübl. Translated by H. O. Klein. 7s. 6d.

Natural-colour Photography. By Dr. E. König. Translated by E. J. Wall. 2s.

Colour Photography with the Lumière Autochrome Plates. By George E. Brown and C. Welborne Piper. 2d.

The Copyright (Works of Art) Act (1862).

An Act for Amending the Law relating to Copyright in Works of the Fine Arts, and for Repressing the Commission of Fraud in the Production and Sale of Such Works.

WHEREAS by law, as now established, the authors of paintings, drawings, and photographs have no copyright in such their works, and it is expedient that the law should in that respect be amended. Be it therefore enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords spiritual and temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

Copyright in Works Hereafter Made or Sold to Vest in the Author for his Life, and for Seven Years after his Death.

1. The author, being a *British* subject or resident within the dominions of the Crown, of every original painting, drawing, and photograph which shall be or shall have been made either in the *British* dominions or elsewhere, and which shall not have been sold or disposed of before the commencement of this Act, and his assigns, shall have the sole and exclusive right of copying, engraving, reproducing, and multiplying such painting or drawing, and the design thereof, or such photograph, and the negative thereof, by any means and of any size, for the term of the natural life of such author, and seven years after his death; provided that when any painting or drawing, or the negative of any photograph, shall for the first time after the passing of this Act be sold or disposed of, or shall be made or executed for or on behalf of any other person for a good or a valuable consideration, the person so selling or disposing of or making or executing the same shall not retain the copyright thereof, unless it be expressly reserved to him by agreement in writing, signed, at or before the time of such sale or disposition, by the vendee or assignee of such painting or drawing, or of such negative of a photograph, or by the person for or on whose behalf the same shall be so made or executed; but the copyright shall belong to the vendee or assignee of such painting or drawing, or of such negative of a photograph, or to the person for or on whose behalf the same shall have been made or executed; nor shall the vendee or assignee thereof be entitled to any such copyright, unless,

at or before the time of such sale or disposition, an agreement in writing, signed by the person so selling or disposing of the same, or by his agent duly authorised, shall have been made to that effect.

Copyright not to Prevent the Representation of the Same Subjects in Other Works.

2. Nothing herein contained shall prejudice the right of any person to copy or use any work in which there shall be no copyright, or to represent any scene or object, notwithstanding that there may be copyright in some representation of such scene or object.

Assignments, Licences, etc., to be in Writing.

3. All copyright under this Act shall be deemed personal or moveable estate, and shall be assignable at law, and every assignment thereof, and every licence to use or copy by any means or process the design or work which shall be the subject of such copyright, shall be made by some note or memorandum in writing, to be signed by the proprietor of the copyright, or by his agent appointed for that purpose in writing.

Register of Proprietors of Copyrights in Paintings, Drawings, and Photographs to be kept at Stationers' Hall, as in 5 and 6 Vict., cap. 45.

4. There shall be kept at the Hall of the Stationers' Company by the Officer appointed by the said Company for the purposes of the Act passed in the sixth year of Her present Majesty, intituled *An Act to Amend the Law of Copyright*, a book or books, entitled "The Register of Proprietors of Copyright in Paintings, Drawings, and Photographs," wherein shall be entered a memorandum of every copyright to which any person shall be entitled under this Act, and also of every subsequent assignment of any such copyright; and such memorandum shall contain a statement of the date of such agreement or assignment, and of the names of the parties thereto, and of the name and place of abode of the person in whom such copyright shall be vested by virtue thereof, and of the name and place of abode of the author of the work in which there shall be such copyright, together with a short description of the nature and subject of such work and in addition thereto, if the person registering shall so desire, a sketch, outline, or photograph of the said work, and no proprietor of any such copyright shall be entitled to the benefit of this Act until such registration, and no action shall be sustainable nor any penalty recoverable in respect of anything done before registration.

Certain Enactments of 5 and 6 Vict., c. 45, to Apply to the Books to be Kept under this Act.

5. The several enactments in the said Act of the sixth year of Her present Majesty contained, with relation to keeping the register book thereby required, and the inspection thereof, the searches therein, and the delivery of certified and stamped copies thereof, the reception of

such copies in evidence, the making of false entries in the said book, and the production in evidence of papers falsely purporting to be copies of entries in the said book the application to the Courts and Judges by persons aggrieved by entries in the said book, and the expunging and varying such entries, shall apply to the book or books to be kept by virtue of this Act, and to the entries and assignments of copyright and proprietorship therein under this Act, in such and the same manner as if such enactments were here expressly enacted in relation thereto, save and except that the forms of entry prescribed by the said Act of the sixth year of Her present Majesty may be varied to meet the circumstances of the case, and that the sum to be demanded by the officer of the said Company of Stationers for making any entry required by this Act shall be one shilling only.

Penalties on Infringement of Copyright.

6. If the author of any painting, drawing, or photograph in which there shall be subsisting copyright, after having sold or disposed of such copyright, or if any other person, not being the proprietor for the time being of copyright in any painting, drawing, or photograph, shall, without the consent of such proprietor, repeat, copy, colourably imitate, or otherwise multiply for sale, hire, exhibition, or distribution, or cause or procure to be repeated, copied, colourably imitated, or otherwise multiplied for sale, hire, exhibition, or distribution, any such work or the design thereof, or, knowing that any such repetition, copy, or other imitation has been unlawfully made, shall import into any part of the United Kingdom, or sell, publish, let to hire, exhibit, or distribute, or offer for sale, hire, exhibition, or distribution, or cause or procure to be imported, sold, published, let to hire, distributed, or offered for sale, hire, exhibition, or distribution, any repetition, copy, or imitation of the said work, or of the design thereof, made without such consent as aforesaid, such person for every such offence shall forfeit to the proprietor of the copyright for the time being a sum not exceeding ten pounds; and all such repetitions, copies, and imitations, made without such consent as aforesaid, and all negatives of photographs made for the purpose of obtaining such copies, shall be forfeited to the proprietor of the copyright.

Penalties on Fraudulent Productions and Sales.

7. No person shall do or cause to be done any or either of the following Acts: that is to say,—

First, no person shall fraudulently sign or otherwise affix, or fraudulently cause to be signed or otherwise affixed to or upon any painting, drawing, or photograph, or the negative thereof, any name, initials, or monogram:

Secondly, no person shall fraudulently sell, publish, exhibit, or dispose of, or offer for sale, exhibition, or distribution, any painting, drawing, or photograph, or negative of a photograph, having thereon the name, initials, or monogram, of a person who did not execute or make such work:

Thirdly, no person shall fraudulently utter, dispose, or put off, or cause to be uttered or disposed of, any copy or colourable imitation of any painting, drawing, or photograph, or negative of a photograph, whether there shall be subsisting copyright therein or not, as having been made or executed by the author or maker of the original work from which such copy or imitation shall have been taken.

Fourthly, where the author or maker of any painting, drawing, or photograph, or negative of a photograph, made either before or after the passing of this Act, shall have sold or otherwise parted with the possession of such work, if any alteration be afterwards made therein by any other person, by addition or otherwise, no person shall be at liberty, during the life of the author or maker of such work, without his consent, to make or knowingly to sell or publish, or offer for sale, such work or any copies of such work so altered as aforesaid, or of any part thereof, as or for the unaltered work of such author or maker.

Penalties.

Every offender under this section shall, upon conviction, forfeit to the person aggrieved a sum not exceeding ten pounds, or not exceeding double the full price, if any, at which all such copies, engravings, imitations, or altered works shall have been sold or offered for sale; and all such copies, engravings, or imitations, or altered works shall be forfeited to the person, or the assigns, or legal representatives of the person whose name, initials, or monogram shall be so fraudulently signed or affixed thereto, or to whom such spurious or altered work shall be so fraudulently or falsely ascribed as aforesaid: Provided always, that the penalties imposed by this section shall not be incurred unless the person whose name, initials, or monogram shall be so fraudulently signed or affixed, or to whom such spurious or altered work shall be so fraudulently or falsely ascribed as aforesaid, shall have been living at or within twenty years next before the time when the offence may have been committed.

Recovery of Pecuniary Penalties.

8. All pecuniary penalties which shall be incurred, and all such unlawful copies, imitations, and all other effects and things as shall have been forfeited by offenders, pursuant to this Act, and pursuant to any Act for the protection of copyright engravings, may be recovered by the person hereinbefore and in any such Act as aforesaid empowered to recover the same respectively, and hereinafter called the complainant or the complainer, as follows:—

In *England* and *Ireland*, either by action against the party offending or by summary proceeding before any two Justices having jurisdiction where the party offending resides:

In *Scotland*, by action before the Court of Session in ordinary form, or by summary action before the Sheriff of the County where the offence may be committed or the offender resides, who, upon proof of the offence or offences, either by confession of the party offending or by the oath or affirmation of one or

more credible witnesses, shall convict the offender, and find him liable to the penalty or penalties aforesaid, as also in expenses; and it shall be lawful for the Sheriff, in pronouncing such judgment for the penalty or penalties and costs, to insert in such judgment a warrant, in the event of such penalty or penalties and costs not being paid, to levy and recover the amount of the same by poinding: Provided always, that it shall be lawful to the Sheriff, in the event of his dismissing the action and assoilzieing the defender, to find the complainer liable in expenses, and any judgment as to be pronounced by the Sheriff in such summary application shall be final and conclusive, and not subject to review by advocacy, suspension, reduction, or otherwise.

Superior Courts of Record in which any Action is Pending may Make an Order for an Injunction, Inspection, or Account.

9. In any action in any of Her Majesty's Superior Courts of Record at Westminster and in Dublin, for the infringement of any such copyright as aforesaid, it shall be lawful for the Court in which such action is pending, if the Court be then sitting, or if the Court be not sitting then, for a judge of such Court, on the application of the plaintiff or defendant respectively, to make such order for an injunction, inspection, or account, and to give such direction respecting such action, injunction, inspection, or account, and the proceedings therein respectively, as to such Court or Judge may seem fit.

Importation of Pirated Works Prohibited.—Application in such Cases of Customs Act.

10. All repetitions, copies, or imitations of paintings, drawings, or photographs, wherein or in the design whereof there shall be subsisting copyright under this Act, and all repetitions, copies, and imitations of the design of any such painting or drawing, or of the negative of any such photograph, which, contrary to the provisions of this Act, shall have been made in any Foreign State, or in any part of the British dominions, are hereby absolutely prohibited to be imported into any part of the United Kingdom except by or with the consent of the proprietor of the copyright thereof, or his agent authorised in writing; and if the proprietor of any such copyright, or his agent, shall declare that any goods imported are repetitions, copies, or imitations of any such painting, drawing, or photograph, or of the negative of any such photograph, and so prohibited as aforesaid, then such goods may be detained by the Officers of Her Majesty's Customs

Saving of Right to Bring Action for Damages.

11. If the author of any painting, drawing, or photograph, in which there shall be subsisting copyright, after having sold or otherwise disposed of such copyright, or if any other person, not being the proprietor for the time being of such copyright, shall, without the consent of such proprietor, repeat, copy, colourably

imitate, or otherwise multiply, or cause to procure to be repeated, copied, or colourably imitated, or otherwise multiplied for sale, hire, exhibition, or distribution, any such work or the design thereof, or the negative of any such photograph, or shall import or cause to be imported into any part of the United Kingdom, or sell, publish, let to hire, exhibit, or distribute, or offer for sale, hire, exhibition, or distribution, or cause or procure to be sold, published, let to hire, exhibited or distributed, or offered for sale, hire, exhibition, or distribution, any repetition, copy, or imitation of such work, or the design thereof, or the negative of any such photograph, made without such consent as aforesaid, then every such proprietor, in addition to the remedies hereby given for the recovery of any such penalties, and forfeiture of any such things as aforesaid, may recover damages by and in a special action on the case, to be brought against the person so offending, and may in such action recover and enforce the delivery to him of all unlawful repetitions, copies, and imitations, and negatives of photographs, or may recover damages for the retention or conversion thereof: Provided that nothing herein contained, nor any proceeding, conviction, or judgment, for any act hereby forbidden, shall effect any remedy which any person aggrieved by such Act may be entitled to either at law or in equity.

Provisions of 7 and 8 Vict., c. 12, to be Considered as Included in this Act.

12. This Act shall be considered as including the provisions of the Act passed in the Session of Parliament held in the seventh and eighth years of her Present Majesty, intituled *An Act to Amend the Law Relating to International Copyright*, in the same manner as if such provisions were part of this Act.

REPRODUCTION FEES.

The Copyright Union has drawn attention to the following suggestions, drawn up for the guidance of its members, by Mr. Alfred Ellis:—

Members are advised not to give permission for their copyright photographs to be reproduced until they have full particulars of the size and style of the proposed reproduction, when they can formulate their charges accordingly. For example: a newspaper should pay a fee of not less than 10s. 6d. for half-tone black-and-white reproduction not exceeding 6 by 4 inches, when printed with letterpress in one issue of a newspaper; but, if it is to be printed as an inset, the fee should be at least one guinea. If printed in colours, collogtype, or photogravure, it should be a still higher fee. If a photograph is to be reproduced for advertising purposes, a higher fee should be charged than for newspaper work. In all cases the permission must be in writing, and should state the fee to be paid, the process by which the photograph is to be reproduced, and whether in black-and-white or colours, the size limit, and the purpose for which the reproduction may be used.

The fee for reproduction on postcards should be not less than 10s. 6d. royalty per thousand for half-tone or collogtype, and £1 1s. per thousand for bromide or ordinary photographic processes.

THE POISONS ACT.

The following is a list of poisons scheduled in the Poisons Act:—

SCHEDULE A.

Part 1.—Arsenic, and its preparations; aconite, and its preparations; alkaloids—all poisonous vegetable alkaloids and their salts; preparations of atropine; cantharides; corrosive sublimate; cyanides of potassium, and all metallic cyanides and the preparations of such articles; emetic tartar; ergot of rye, and its preparations; prussic acid, and its preparations; savin, and its oil; strychnine, and its preparations.

Part 2.—Essential oil of almonds (unless deprived of its prussic acid); belladonna and its preparations; tincture and all vesicating liquid preparations of cantharides; liquid preparations of carbolic acid, and homologues (if containing more than 3 per cent. of such substances); chloroform; chloral hydrate, and its preparations; preparations of corrosive sublimate; preparations of morphine; nuxvomica, and its preparations; opium, and all preparations of opium or of poppies; oxalic acid; red precipitate (red oxide of mercury); white precipitate (ammoniated mercury). Cocaine and its salts, picrotoxin, preparations of cocaine, digitalis and its preparations, mercuric iodide, mercuric sulphocyanide, strophanthus and its preparations.

These poisons must not be sold by any except certified pharmacists under penalty of £5 for each offence. Poisons sold either retail or wholesale must be distinctly labelled with the name of the poison, the name and address of the seller, and the word "poison." In the case of the poisons in Part 1, it is forbidden to sell the same to any person unknown to the seller unless introduced by a person known to the seller, and on every sale the seller shall, before delivery, have entered in a book for the purpose the date of sale, name and address of the purchaser, name and quantity of the article sold, and the purpose for which it is required, to which entry the purchaser shall attach his signature.

TABLES.

WEIGHTS AND MEASURES.

The formulæ in the editorial pages of this ALMANAC are given, in almost all cases, in both British and metric measures, and in adopting this course we have had the desire to impress upon photographers the simplicity and facility of the latter system. As a rule, the British formulæ are expressed in grains or ounces per 20 ozs. of solution, and the metric formulæ in grammes per 1000 c.c.s. In regard to the total bulk of solution, our formulæ are mostly drawn up on the basis that the total bulk after the solution of the solids is that stated in the formula, 20 ozs. or 1000 c.c.s. as a rule.

The question of a 10 per cent. solution is a point in formulæ making and using which has caused endless discussion; but it is really simple enough if it be borne in mind that the ounce avoirdupois contains 437½ grains, while the fluid ounce contains 480 minims. As 10 per cent. solutions, being strong, are usually measured out in minims, the ounce avoirdupois must be dissolved in enough water to make a solution containing 1 grain in 10 minims; that is to say, 4375 minims, or practically 9 ounces, is the proper bulk for the solution of 1 ounce avoirdupois. But if a solution is to be measured out in fluid ounces, then the 10 per cent. solution will be 1 oz. in 10 fluid ozs.

Throughout this work "grains per ounce" are converted into "grammes per litre" by multiplying by 2.3. Ounces per any given number of fluid ounces are converted by taking the same ratio of grammes to 1000 c.c.s.

In reference to the names of chemicals, "sodium carbonate" and "sodium sulphite" are used for the crystallised forms of these substances. If the dry or anhydrous forms are meant, one or other of these terms is used in qualification.

British Weights and Measures.

1. APOTHECARIES WEIGHT.*

- 20 Grains = 1 Scruple.
 3 Scruples = 1 Drachm = 60 Grains.
 8 Drachms = 1 Ounce = 480 Grains.

2. AVOIRDUPOIS WEIGHT.*

- 437½ Grains = 1 Ounce.
 16 Ounces = 1 Pound = 7000 Grains.
 ¼ ounce = 109 grains; ½ ounce = 219 grains; ¾ ounce = 328 grains.

3. FLUID MEASURE.

- 60 Minims = 1 Drachm.
 8 Drachms = 1 Ounce = 480 Minims.
 20 Ounces = 1 Pint = 160 Drachms = 9600 Minims.
 2 Pints = 1 Quart = 40 Ounces = 320 Drachms.
 4 Quarts = 1 Gallon = 160 Ounces = 1280 Drachms.
 1 fluid ounce of water weighs 437½ grains, therefore every minim weighs 0·91 grains.

Metric Weights and Measures.

The unit of weight is the gramme, written "gm."; the subdivisions are the "deci-" (1/10th), "centi-" (1/100th), and "milligramme" (1/1000th); the multiples are the "deka-" (10 gm.) and "hectogramme" (100 gm.), but in practice it is usual to use the term "1 or ·01 and 10 or 100 grammes, and the abbreviation "kilo." for 1000 gms.

The following are the equivalents of Metric Weights and Measures in terms of Imperial Weights and Measures:—

LINEAR MEASURE.

- 1 Millimetre (mm.) (1/1000th M.) = 0·03937 inch
 1 Centimetre (1/100th M.) .. = 0·3937 "
 1 Metre (M.) = { 39 370113 inches
 3·280843 feet
 1·0936143 yards
 Kilometre (1000 M.) = 0·62137 mile

SQUARE MEASURE.

- 1 Square Centimetre = 0·155 square inch
 1 Square Metre (100 square decimetres) = { 10·7639 square feet
 1·196 square yards

WEIGHT. *Avoirdupois.*

- 1 Milligramme (1/1000th gm.) .. = 0·015 grain
 1 Gramme (1 gm.) = 15·432 "
 1 Kilogramme (1000 gm.) .. = { 2·2046223 lbs. or
 35·273957 ozs.

* It is now customary in formulæ to employ the avoirdupois ounce (437½ grains); but in cases where "drachms" are given the apothecaries drachm of 60 grains is taken as the unit.

FLUID MEASURE.

1 Cubic centimetre* (c.c.) (1/1000th litre) = 16.9 minims

1 Litre (1 L.) = 35 ozs. 94 m. = 16894.1 minims

Conversion of Metric into British Measures.

GMS. PER LITRE INTO GRAINS PER 10* OZS.

The following table gives the most convenient means of translating metric formulæ into British measures.

* The figures given in Columns 2, 4, and 6 are a correct translation of the metric proportion when the solution is measured out in ounces and fractions of an ounce. If to be measured in minims, the quantities in Columns 2, 4, and 6 are dissolved in 9 ozs. 2 drams of water.

1	2	3	4	5	6
Gms. Per Litro.	Grs. Per 10* ozs.	Gms. Per Litro.	Grs. Ozs. Grs. Per 10* ozs.	Gms. Per Litro.	Grs. Ozs. Grs. Per 10* ozs.
1	4.4	30	131 1/4—22	155	678 1 1/4—22
2	8.8	35	153 1/2—44	160	700 1 1/2—44
3	13.1	40	175 3/4—66	165	722 1 3/4—66
4	17.5	45	197 3/4—88	170	744 1 3/4—88
5	21.9	50	219 3/4—0	175	766 1 3/4—0
6	26.2	55	241 3/4—22	180	788 1 3/4—22
7	30.6	60	262 3/4—43	185	809 1 3/4—43
8	35.0	65	284 3/4—65	190	831 1 3/4—65
9	39.4	70	306 3/4—87	195	853 1 3/4—87
10	43.8	75	328 3/4—0	200	875 2
11	48.1	80	350 3/4—22	225	984 2 1/4
12	52.5	85	371 3/4—43	250	1,094 2 1/4
13	56.9	90	393 3/4—65	275	1,203 2 1/4
14	61.2	95	415 3/4—87	300	1,313 3
15	65.6	100	437 1—0	325	1,422 3 1/4
16	70.0	105	459 1—22	350	1,531 3 1/4
17	74.4	110	481 1—44	375	1,641 3 1/4
18	78.8	115	503 1—66	400	1,750 4
19	83.1	120	525 1—88	425	1,859 4 1/4
20	87.5	125	547 1 1/4—0	450	1,969 4 1/4
21	91.9	130	569 1 1/4—22	475	2,078 4 1/4
22	96.2	135	591 1 1/4—44	500	2,187 5
23	100.6	140	613 1 1/4—66		
24	105.0	145	634 1 1/4—87		
25	109.4	150	656 1 1/2—0		

* N.B.—Quantities in Columns 2, 4, and 6 are dissolved in 9 ozs. 2 drams when solutions are to be measured out in minims.

* N.B.—Quantities in Columns 2, 4, and 6 are dissolved in 9 ozs. 2 drams when solutions are to be measured out in minims.

* *Millilitre and C.C.*—Revisions of metric standards have shown that the litre is not exactly 1000 c.c.s., but 999.84 c.c.s. (according to Mendeleef's calculations from the experimental data). The difference appears sufficiently serious in official circles to warrant the abandonment of the term "cubic centimetre," and the employment of "millilitre" for the true thousandth part; millilitre to be abbreviated to "mil." On grounds of terminology there is some reason for this, but until "millilitre" commences to oust c.c. from current writings we shall continue to use the latter term. As regards error, the difference is absolutely negligible, not more than 4 drops in 35 ozs.

GRAMMES INTO GRAINS AND OUNCES (AVOIRDUPOIS).

Gms.	Ozs.	Grs.	Gms.	Ozs.	Grs.	Gms.	Ozs.	Grs.
0.1		1.5	16	$\frac{1}{2}$	28.1	130	$4\frac{1}{2}$	37
0.2		3.1	17	$\frac{1}{2}$	43.5	140	$4\frac{1}{2}$	82
0.3		4.6	18	$\frac{1}{2}$	59.0	150	$5\frac{1}{2}$	118
0.4		6.2	19	$\frac{1}{2}$	74.4	160	$5\frac{1}{2}$	61
0.5		7.7	20	$\frac{1}{2}$	89.8	170	6	0
0.6		9.1	25	$\frac{1}{2}$	57.0	175	6	76
0.7		10.8	30	1	25	180	$6\frac{1}{2}$	44
0.8		12.4	35	1	103	190	$6\frac{1}{2}$	88
0.9		13.9	40	$1\frac{1}{2}$	71	200	7	24
1		15.43	45	$1\frac{1}{2}$	38	250	$8\frac{3}{4}$	32
2		30.9	50	$1\frac{1}{2}$	6	300	$10\frac{1}{2}$	31
3		46.3	55	$1\frac{1}{2}$	83	350	$12\frac{1}{2}$	41
4		61.7	60	2	51	400	14	50
5		77.2	65	$2\frac{1}{2}$	19	450	$15\frac{1}{2}$	52
6		92.6	70	$2\frac{1}{2}$	94	500	$17\frac{1}{2}$	61
7		108.0	75	$2\frac{1}{2}$	64	550	$19\frac{1}{2}$	66
8		14.1	80	$2\frac{1}{2}$	32	600	21	70
9	$\frac{1}{4}$	29.5	85	3	0	650	$22\frac{3}{4}$	72
10	$\frac{1}{4}$	44.9	90	3	76	700	$24\frac{1}{2}$	81
11	$\frac{1}{4}$	60.4	95	$3\frac{1}{2}$	44	750	$26\frac{1}{2}$	91
12	$\frac{1}{4}$	75.8	100	$3\frac{1}{2}$	11	800	28	95
13	$\frac{1}{4}$	91.2	110	$3\frac{1}{2}$	56	850	$29\frac{1}{2}$	102
14	$\frac{1}{4}$	106.7	120	4	102	900	$31\frac{1}{2}$	106
15	$\frac{1}{2}$	12.7	125	$4\frac{1}{2}$	70	1000	$35\frac{1}{2}$	11

C.C.S. INTO MINIMS AND OUNCES (FLUID).

C.c.s.	Ozs.	Mins.	C.c.s.	Ozs.	Mins.	C.c.s.	Ozs.	Mins.
1		16.9	14	$\frac{1}{2}$	117	55	$1\frac{3}{4}$	89
2		33.8	15	$\frac{1}{2}$	13	60	2	54
3		50.7	16	$\frac{1}{2}$	30	65	$2\frac{1}{4}$	18
4		67.6	17	$\frac{1}{2}$	47	70	$2\frac{1}{4}$	103
5		84.5	18	$\frac{1}{2}$	64	75	$2\frac{1}{2}$	67
6		101.4	19	$\frac{1}{2}$	81	80	$2\frac{1}{2}$	32
7		118.3	20	$\frac{1}{2}$	98	85	$2\frac{3}{4}$	116
8	$\frac{1}{4}$	15.2	25	$\frac{1}{2}$	82	90	3	81
9	$\frac{1}{4}$	32	30	1	27	95	$3\frac{1}{4}$	45
10	$\frac{1}{4}$	49	35	1	111	100	$3\frac{1}{4}$	10
11	$\frac{1}{4}$	66	40	$1\frac{1}{2}$	76	110	$3\frac{3}{4}$	58
12	$\frac{1}{4}$	83	45	$1\frac{1}{2}$	40	120	4	107
13	$\frac{1}{2}$	100	50	$1\frac{1}{2}$	5	125	$4\frac{1}{2}$	72

C C.S INTO MINIMS AND OUNCES (FLUID) —*Continued*

C c s	Ozs	Minis	C c s	Ozs	Minis	C c s	Ozs	Minis
130	4½	36	350	12½	33	700	24½	66
140	4¾	85	375	13	95	725	25½	8
150	5¼	14	400	14	37	750	26½	70
160	5½	63	425	14½	100	775	27½	13
170	5¾	112	450	15	42	800	28	75
175	6	76	475	16½	105	825	29	18
180	6¼	41	500	17½	47	850	29¾	80
190	6¾	90	525	18½	110	875	30½	22
200	7	20	550	19½	52	900	31½	65
225	7½	81	575	20	114	925	32½	27
250	8½	24	600	21	56	950	33½	90
275	9½	86	625	22	0	975	34½	32
300	10½	28	650	22½	61	1000	35	94
325	11½	90	675	23½	4			

Conversion of British into Metric Measures.

GRAINS INTO GRAMMES

Grs	Gms	Grs	Gms	Grs	Gms
1	0 065	16	1 037	35	2 268
2	0 13	17	1 102	40	2 592
3	0 194	18	1 166	45	2 916
4	0 259	19	1 232	50	3 240
5	0 324	20	1 296	55	3 564
6	0 389	21	1 361	60	3 888
7	0 454	22	1 426	65	4 212
8	0 518	23	1 490	70	4 536
9	0 583	24	1 555	75	4 860
10	0 648	25	1 620	80	5 184
11	0 713	26	1 685	85	5 508
12	0 777	27	1 750	90	5 832
13	0 842	28	1 814	95	6 156
14	0 907	29	1 880	100	6 480
15	0 972	30	1 944		

OUNCES (AVOIRDUPOIS) TO GRAMMES.

Ozs.	Gms.	Ozs.	Gms.	Ozs.	Gms.
$\frac{1}{4}$	7.09	4	113.40	13	368.54
$\frac{1}{2}$	14.17	5	141.75	14	396.89
$\frac{3}{4}$	21.26	6	170.10	15	425.24
1	28.35	7	198.45	16	453.59
$1\frac{1}{2}$	42.5	8	226.80	17	481.94
2	56.70	9	255.15	18	510.29
$2\frac{1}{2}$	70.87	11	311.8	19	538.64
3	85.05	12	340.19	20	566.99

FLUID OUNCES AND DRACHMS TO C.C.S.

Minims.	C.c.s.	Drms.	C.c.s.	Ozs.	C.c.s.	Ozs.	C.c.s.
5	= .3	$\frac{1}{2}$	1.78	$1\frac{1}{2}$	42.6	11	312.5
10	= .6	1	3.55	2	56.8	12	341.0
15	= .9	2	7.10	3	85.2	13	369.3
20	= 1.2	3	10.65	4	113.6	14	398.0
25	= 1.4	4	14.20	5	142.0	15	426.0
		5	17.75	6	170.5	16	454.5
		6	21.30	7	198.9	17	483.0
		7	24.86	8	227.3	18	511.5
		8	28.41	9	255.7	19	540.0
				10	284.0	20	568.0

CONVERSION RULES

Grammes per litre into grains per ounce.—Multiply the grammes by 0.44.

C.c.s. per litre into minims per ounce.—Divide the minims by 2 (more exactly, multiply by 0.48).

Grains per ounce into grammes per litre.—Multiply the grains by 2.3. Thus 50 grs. per oz. = 115 gms. per litre.

Minims per ounce into c.c.s. per litre.—Multiply the minims by 2.

COINS AS WEIGHTS.

Silver coinage, it is useful to note, is minted exactly by weight in proportion to its value, viz., $436\frac{4}{11}$ grains for every 5s. Thus the threepenny bit is 21·8 grs.; a sixpence, 43·6; shilling, 87·2; florin, 175·4; half-crown, 218 grs.

Thus the sixpence and threepenny piece are almost exactly one-tenth and one-twentieth of the avoirdupois ounce.

Bronze coinage—Three pennies, or five halfpennies, or ten farthings = 1 oz. (avoirdupois).

i.e., the penny = 145·8 grs.; 1 halfpenny, 87·5; and 1 farthing, 43·75 grs.

One sovereign weighs 123 27 grs.; the half-sovereign, 61·63 grs.

$\frac{1}{4}$ oz. (avoi.) = one-halfpenny and one threepenny piece.

$\frac{1}{2}$ " " = two halfpennies and a farthing.

1 " " = three pennies (or five halfpennies).

2 " " = six pennies (or ten halfpennies).

4 " " = twelve pennies (or twenty halfpennies.)

FRENCH COINS AS METRIC WEIGHTS.

Lord Crawford gives the following table:—

			<i>Silver Coins.</i>						<i>Bronze Coins</i>		
25 gms...	..		5 francs			10 gms.	..		10 centimes		
10 " ..	..		2 "			5 "	..		5 "		
5 " ..	..		1 "			2 "	..		2 "		
2½ " ..	..		½ "		or 50 centimes	1 "	..		1 "		

PARTS

Formulae given, as many are, in "parts" may be made up by writing gms. for the solid and c.c.s. for the fluid "parts," and converting them into the British measures by any of the tables in this section. Thus: Adurol, 10 parts; sodium sulphite, 100 parts; water 1000 parts becomes adurol, 154 grs.; sodium sulphite, 3 ozs. 230 grs.; water, 35 ozs.

INCHES INTO MILLIMETRES.

MILLIMETRES INTO INCHES.

Inches.	Milli- metres.	Inches.	Milli- metres.	Milli- metres.	Inches.	Milli- metres.	Inches.
1	25.4	$\frac{3}{8}$	9.5	0.1	0.0039	13	0.51
$\frac{1}{16}$	23.8	$\frac{1}{4}$	8.7	0.5	0.015	14	0.55
$\frac{1}{8}$	23.	$\frac{5}{16}$	7.9	1	0.01	15	0.59
$\frac{3}{16}$	22.2	$\frac{3}{8}$	7.1	2	0.08	16	0.63
		$\frac{1}{2}$		3	0.12	17	0.67
$\frac{1}{4}$	20.6	$\frac{3}{4}$	6.4	4	0.16	18	0.71
$\frac{5}{16}$	19.1	$\frac{7}{8}$	5.6	5	0.20	19	0.75
$\frac{3}{8}$	17.5	$\frac{1}{2}$	4.8	6	0.24	20	0.79
		$\frac{5}{8}$		7	0.28	21	0.83
$\frac{7}{16}$	15.9	$\frac{3}{4}$	3.2	8	0.31	22	0.87
$\frac{1}{2}$	14.3	$\frac{7}{8}$	2.4	9	0.53	23	0.90
$\frac{5}{8}$	12.7	$\frac{1}{2}$	1.6	10	0.39	24	0.94
$\frac{3}{4}$	11.1	$\frac{1}{4}$	0.8	11	0.43	25	0.98
		$\frac{1}{8}$		12	0.47	25.4	1.0

ENGLISH SIZES OF PLATES.

Inches.	Cm.	Inches.	Cm.
$3\frac{1}{2} \times 2\frac{1}{2}$	8.9×6.4	$7 \times 5\frac{1}{2}$	17.8×12.7
$3\frac{1}{2} \times 3\frac{1}{4}$ ¹	8.25×8.25	$8\frac{1}{2} \times 6\frac{1}{2}$ ²	21.5×16.5
$4\frac{1}{2} \times 3\frac{1}{2}$ ²	10.8×8.25	10×8	25.4×20.3
$5 \times 4\frac{1}{2}$	12.6×10.1	12×10	30.4×25.4
$6\frac{1}{2} \times 4\frac{1}{2}$ ⁴	16.5×12.0	15×12	38.1×30.4

¹ Lantern plate. ² Quarter-plate. ³ Smallest common size in America. ⁴ Half-plate. ⁵ Usual medium size in America. ⁶ Whole-plate.

CONTINENTAL SIZES OF PLATES IN COMMON USE.

Cm.	Inches	Cm.	Inches.
$9 \times 12^*$	3.54×4.72	18×24	7.08×9.44
12×16	4.72×6.30	24×30	9.44×11.81
$13 \times 18^\dagger$	5.12×7.08	30×40	11.81×15.75
13×21	5.12×8.25	40×50	15.75×19.69

* The standard small size, equivalent to the British quarter-plate.

† The standard medium size (British half-plate).

FOREIGN LANTERN SLIDES.

The standard French size for lantern slides is 20 by 8 cm., though many makers prepare slides $3\frac{1}{2}$ by $3\frac{1}{4}$. The American size is 4 by $3\frac{1}{4}$, though some makers use the English quarter-plate ($4\frac{1}{2}$ by $3\frac{1}{4}$).

A TABLE OF ATOMIC WEIGHTS OF THE CHEMICAL
ELEMENTS.

NAME.	Symbol.	Atomic Weight in Round Numbers.	Accurate Atomic Weight.
Aluminium	Al	27	27.1
Antimony	Sb	120	120.2
Argon	A	40	39.9
Arsenic	As	75	75.0
Barium	Ba	137	137.43
Beryllium	Be = Gl	9 1	9.1
Bismuth	Bi	208	208.0
Boron	B	11	11.00
Bromine	Br	80	79.96
Cadmium	Cd	112	112.4
Cæsium	Cs	133	132.9
Calcium	Ca	40	40.1
Carbon	C	12	12.0
Cerium	Ce	140	140.25
Chlorine	Cl	35 5	35.451
Chromium	Cr	52	52.11
Cobalt	Co	59	59.00
Copper	Cu	63.5	63.60
Erbium	Er	166	166.0
Fluorine	F	19	19.0
Gadolinium	Gd	156	156.01
Gallium	Ga	70	70.0
Germanium	Ge	72.5	72.5
Gold	Au	197	197.2
Helium	He	4	4.0
Hydrogen	H	1	1.008
Indium	In	115	115.0
Iodine	I	127	126.97
Iridium	Ir	193	193.0
Iron	Fe	56	55.9
Lanthanum	La	139	138.9
Lead	Pb	207	206.92
Lithium	Li	7	7.03
Magnesium	Mg	24	24.36
Manganese	Mn	55	55.0
Mercury	Hg	200	200.0

A TABLE OF ATOMIC WEIGHTS—CONTINUED.

NAME.	Symbol.	Atomic Weight in Round Numbers.	Accurate Atomic Weight.
Molybdenum	Mo	96	96.0
Neodymium	Nd	144	143.6
Nickel	Ni	59	58.70
Niobium	Nb—Cb	94	94.0
Nitrogen	N	14	14.04
Osmium	Os	191	191.0
Oxygen (Standard)	O	16	16.0
Palladium	Pd	106	106.5
Phosphorus	P	31	31.0
Platinum	Pt	193.4	194.8
Potassium	K	39	39.15
Praseodymium	Pr	141	140.5
Rhodium	Rh	103	103.0
Rubidium	Rb	85	85.5
Ruthenium	Ru	102	101.7
Samarium	Sm	150	150.3
Scandium	Sc	44	44.1
Selenium	Se	79	79.2
Silicon	Si	28	28.4
Silver	Ag	108	107.93
Sodium	Na	23	23.05
Strontium	Sr	87.5	87.6
Sulphur	S	32	32.06
Tantalum	Ta	183	183.0
Tellurium	Te	128	127.6
Terbium	Tb	160	160.0
Thallium	Tl	204	204.1
Thorium	Th	233	232.5
Thulium	Tu	171	171.0
Tin	Sn	118	119.0
Titanium	Ti	48	48.1
Tungsten	W	184	184.0
Uranium	U	240	238.5
Vanadium	V	51	51.4
Ytterbium	Yb	173	173.0
Yttrium	Yt	89	89.0
Zinc	Zn	65	65.4
Zirconium	Zr	91	90.6

CHEMICAL TABLES.

TABLE OF SYMBOLS AND EQUIVALENT WEIGHTS OF THE MORE IMPORTANT COMPOUNDS USED IN PHOTOGRAPHY.

The atomic weights of the elements employed in working out the equivalent weights given below are the round numbers contained in the first column of the Table of Atomic Weights on page 908.

NAME.	SYMBOL.	EQUIV. WEIGHT
Acetone	$C_3 H_6 O$	58
„ sulphite	$C_3 H_6 OH SO_3 Na$	162
Acid, acetic	$C_2 H_4 O_2$	60
„ benzoic	$C_6 H_5 COOH$	122
„ boric	$H_3 BO_3$	62
„ carbolic	$C_6 H_5 OH$	94
„ chlorochromic	$Cl Cr O_2 OH$	136.5
„ chromic (anhydride)	$Cr O_3$	100
„ citric	$C_6 H_8 O_7 H_2 O$	210
„ dithionic	$H_2 S_2 O_6$	162
„ formic	$H_2 CO_2$	46
„ gallic	$C_6 H_2 (OH)_3 COOH, H_2 O$	188
„ hydrobromic	$H Br$	81
„ hydrochloric	$H Cl$	36.5
„ hydrofluoric	$H F$	34
„ lactic	$CH_3 CH (OH) COOH$	90
„ nitric	HNO_3	63
„ oxalic	$H_2 C_2 O_4$	126
„ pentathionic	$H_2 S_5 O_6$	258
„ perchromic	$H Cr O_4$	117
„ phosphoric	$H_3 PO_4$	98
„ picric	$C_6 H_2 (NO_2)_3 OH$	139
„ pyrogallie	$C_6 H_3 (OH)_3$	126
„ salicylic	$C_6 H_4 (OH) COOH$	138
„ sulphuric	$H_2 SO_4$	98
„ sulphurous	$H_2 SO_3$	82
„ tannic	$C_{14} H_{10} O_9$	322
„ tartaric	$C_4 H_2 (OH)_2 (COOH)_2$	150
„ tetrathionic	$H_2 S_4 O_6$	225
„ trithionic	$H_2 S_3 O_6$	194
Adurol*	$C_6 H_3 (OH)_2 Cl$ (or Br)	—
Alcohol (methyl)	$CH_3 OH$	32
„ (ethyl)	$C_2 H_5 OH$	46

* Adurol is mono-chlor (or mono-brom) hydroquinone.

TABLES OF SYMBOLS, ETC.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Alum, ammonia	$\text{Al}_2 (\text{NH}_4)_2 (\text{SO}_4)_4 \cdot 24\text{H}_2\text{O}$..	906
„ chrome	$\text{Cr}_2 \text{K}_2 (\text{SO}_4)_4 \cdot 24\text{H}_2\text{O}$	998
„ iron ammonia	$\text{Fe}_2 (\text{NH}_4)_2 (\text{SO}_4)_4 \cdot 24\text{H}_2\text{O}$..	964
„ potash	$\text{Al}_2 \text{K}_2 (\text{SO}_4)_4 \cdot 24\text{H}_2\text{O}$	948
Aluminium chloride	$\text{Al}_2 \text{Cl}_6 \cdot 12\text{H}_2\text{O}$	267
„ sulphate	$\text{Al}_2 (\text{SO}_4)_3 \cdot 16\text{H}_2\text{O}$	634
„ sulphocyanide	$\text{Al}_2 (\text{CNS})_6$	402
Amidol	$\text{C}_6 \text{H}_3 \text{OH NH}_2 \text{HCl}$	144.5
Ammonia	NH_3	17
Ammonium bichromate	$(\text{NH}_4)_2 \text{Cr}_2 \text{O}_7$	252
„ bromide	$\text{NH}_4 \text{Br}$	98
„ carbonate	$\text{NH}_4 \text{HCO}_3 + \text{NH}_2 \text{COOH NH}_4$ —	—
„ chloride	$\text{NH}_4 \text{Cl}$	53.5
„ chromate	$(\text{NH}_4)_2 \text{Cr}_2 \text{O}_4$	152
„ citrate	$(\text{NH}_4)_2 \text{C}_6 \text{H}_6 \text{O}_7$	226
„ iodide	$\text{NH}_4 \text{I}$	145
„ molybdate	$(\text{NH}_4)_6 \text{Mo}_7 \text{O}_{24} \cdot 4\text{H}_2\text{O}$	1236
„ nitrate	$\text{NH}_4 \text{NO}_3$	80
„ oxalate	$(\text{NH}_4)_2 \text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$	142
„ persulphate	$(\text{NH}_4)_2 \text{S}_2 \text{O}_8$	228
„ phosphate	$(\text{NH}_4)_2 \text{HPO}_4$	132
„ sulphate	$(\text{NH}_4)_2 \text{SO}_4$	132
„ sulphide	$\text{NH}_4 \text{S}$	50
„ sulphocyanide	$\text{NH}_4 \text{CNS}$	76
„ vanadate	$\text{NH}_4 \text{VO}_3$	117
Amyl acetate	$\text{C}_7 \text{H}_{14} \text{O}_2$	130
„ alcohol	$(\text{CH}_3)_2 \text{CH CH}_2 \text{CH}_2 \text{OH}$	88
Aniline	$\text{C}_6 \text{H}_5 \text{NH}_2$	93
• “Anthon” (potass. persulphate) ..		
Antimony, sulphide	$\text{Sb}_2 \text{S}_3$	336
Aurantia	$(\text{O}_6 \text{H}_2 (\text{NO}_2)_2)_2 \text{N NH}_4$	456
Aurine	$\text{C} (\text{C}_6 \text{H}_4 \text{OH})_2 \text{C}_6 \text{H}_4 \text{O}$	290
Barium, bromide	$\text{Ba Br}_2 \cdot 2\text{H}_2\text{O}$	333
„ chloride	$\text{Ba Cl}_2 \cdot 2\text{H}_2\text{O}$	244
„ iodide	Ba I_2	391
„ nitrate	$\text{Ba} (\text{NO}_3)_2$	261
„ peroxide	BaO_3	201
„ sulphate	Ba SO_4	233
Benzole (benzene)	$\text{C}_6 \text{H}_6$	78
Borax (see Sodium borate)		
Bromine	Br	80
Cadmium, bromide	$\text{Cd Br}_2 \cdot 4\text{H}_2\text{O}$	344
„ chloride	Cd Cl_2	183
„ iodide	Cd I_2	366
Calcium, carbide	$\text{Ca}_2 \text{C}$	92
„ carbonate	Ca CO_3	100
„ chloride (cryst.)	$\text{Ca Cl}_2 \cdot 6\text{H}_2\text{O}$	219

TABLE OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Calcium, chloride (fused)	Ca Cl_2	111
„ hypochlorite	Ca (O Cl)_2	153
„ sulphate	$\text{Ca SO}_4 \cdot 2\text{H}_2\text{O}$	172
„ hydroxide (slaked lime) ..	Ca (OH)_2	74
Carbon, bisulphide	C S_2	76
Celloidin	$\text{C}_{12} \text{H}_{16} \text{O}_6 (\text{NO}_3)_4$	504
Ceric, sulphate	$\text{Ce (SO}_4)_2 \cdot 4\text{H}_2\text{O}$	404
Chloral hydrate	$\text{C Cl}_3 \text{ CH (OH)}_2$	165.5
Chloroform	CH Cl_3	119.5
Chrysoidine	$\text{C}_6 \text{H}_5 \text{N}_2 \text{C}_6 \text{H}_3 (\text{NH}_2)_2$	211.7
Cobalt, chloride	$\text{Co Cl}_2 \cdot 6\text{H}_2\text{O}$	238
Copper, bromide	Cu Br_2	223.5
„ chloride	$\text{Cu Cl}_2 \cdot 2\text{H}_2\text{O}$	170.5
„ nitrate	$\text{Cu (NO}_3)_2 \cdot 6\text{H}_2\text{O}$	357.5
„ sulphate	$\text{Cu SO}_4 \cdot 5\text{H}_2\text{O}$	249.5
Cyanine	$\text{C}_{29} \text{H}_{35} \text{N}_2 \text{I}$	544
Dextrine	$(\text{C}_6 \text{H}_{10} \text{O}_5)_x$	—
Diamidophenol	$\text{C}_6 \text{H}_3 \text{OH (NH}_2)_2$	124
Edinol*	—	—
Eikonogen†	$\text{C}_{10} \text{H}_5 (\text{OH}) \text{NH}_2 \text{SO}_3 \text{O Na}$	263
Eosine	Na or K Salt of	—
„	$\text{C}_6 \text{H}_4 (\text{CO})_2 \text{O (C}_6 \text{H OH X}^\dagger)_2$..	—
Erythrosine	$\text{C}_6 \text{H}_4 (\text{CO})_2 \text{O (C}_6 \text{H OH X}^\dagger)_2$..	—
„	$\text{C}_4 \text{H}_{10} \text{O}$	74
Ether	40 % sol. of CH_3O	—
Ferrous and ferric salts (See Iron)	—	—
Formaline	$\text{C}_3 \text{H}_5 (\text{OH})_3$	92
Glycerine	$\text{C}_6 \text{H}_4 \text{OH NHCH}_2 \text{COOH}$..	167
Glycine§	$\text{H Au Cl}_4 \cdot 4\text{H}_2\text{O}$	412
Gold, chloride yellow	H Au Cl_4	340
„ „ brown	$\text{K Au Cl}_4 \cdot 2\text{H}_2\text{O}$	414
„ „ potassium	$\text{Na Au Cl}_4 \cdot 2\text{H}_2\text{O}$	398
„ „ sodium	H_2O_2	34
Hydrogen, peroxide	$\text{C}_6 \text{H}_4 (\text{OH})_2$	110
Hydroquinone	I	127
Iodine	Ir Cl_3	299.5
Iridious chloride	Ir Cl_4	335
„ tetrachloride	$\text{K}_2 \text{Ir Cl}_6$	484
„ potassium „	$\text{Na}_2 \text{Ir Cl}_6$	452
„ sodium „	—	—
IRON.	—	—
Ferric chloride (dry)	$\text{Fe}_2 \text{Cl}_6$	325

* Edinol is the hydrochloride of γ -amido-oxy-benzyl-alcohol.

† Eikonogen is the sodium salt of amido- β -naphthol- β -monosulphuric acid.

‡ The X in these formulæ may be bromine, iodine, or chlorine, which elements in other proportions constitute the various commercial dyes.

§ Glycine is γ -oxyphenyl-glycine or γ -oxyphenyl-amido-acetic acid.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL	EQUIV. WEIGHT.
Ferric chloride (lump)	$\text{Fe}_2 \text{Cl}_6 \cdot 12\text{H}_2\text{O}$	541
„ ammonia citrate, brown..	$4 \text{ Fe C}_6 \text{ H}_5 \text{ O}_7 \cdot 3 (\text{NH}_4)_3$ $\text{C}_6 \text{ H}_5 \text{ O}_7 \cdot 3 \text{ Fe} (\text{OH})_3$	2030
„ „ „ green ..	$5 \text{ Fe C}_6 \text{ H}_5 \text{ O}_7 \cdot 2 (\text{NH}_4)_3 \text{ C}_6 \text{ H}_5 \text{ O}_7$ $\text{NH}_4 \text{ C}_6 \text{ H}_7 \text{ O}_7 \cdot 2\text{H}_2\text{O}$	1956
„ oxalate	$\text{Fe}_2 (\text{C}_2 \text{ O}_4)_3$	376
„ ammonium oxalate.....	$(\text{NH}_4)_3 \text{ Fe} (\text{C}_2 \text{ O}_4)_3 \cdot 3\text{H}_2\text{O}$	428
„ potassium „	$\text{K}_3 \text{ Fe} (\text{C}_2 \text{ O}_4)_3 \cdot 3\text{H}_2\text{O}$	491
„ sodium „	$\text{Na}_6 \text{ Fe} (\text{C}_2 \text{ O}_4)_6 \cdot 11\text{H}_2\text{O}$	976
Ferrous, chloride (dry)	Fe Cl_2	127
„ „ (cryst.)	$\text{Fe Cl}_2 \cdot 4\text{H}_2\text{O}$	199
„ oxalate	$\text{Fe C}_2 \text{ O}_4 \cdot 2\text{H}_2\text{O}$	180
„ potassium oxalate	$\text{K}_2 \text{ Fe} (\text{C}_2 \text{ O}_4)_2 \cdot \text{H}_2\text{O}$	328
„ sulphate	$\text{Fe SO}_4 \cdot 7\text{H}_2\text{O}$	278
„ ammonia sulphate.....	$\text{Fe} (\text{NH}_4)_2 (\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$	392
Lead, acetate	$\text{Pb} (\text{C}_2 \text{ H}_3 \text{ O}_2)_2 \cdot 3\text{H}_2\text{O}$	379
„ nitrate	$\text{Pb} (\text{NO}_3)_2$	331
Lithia, caustic	Li OH	24
Lithium, bromide	Li Br	87
„ carbonate	$\text{Li}_2 \text{ CO}_3$	74
Lithium, chloride	Li Cl (cryst. has $2\text{H}_2\text{O}$)....	42.5
„ iodide	Li I	134
Magnesium, chloride	Mg Cl_2	95
„ sulphate.....	$\text{Mg SO}_4 \cdot 7\text{H}_2\text{O}$	246
Manganese, peroxide	Mn O_2	87
„ sulphate	$\text{Mn SO}_4 \cdot 4\text{H}_2\text{O}$	225
Mercury.....	Hg	200
„ bichloride	Hg Cl_2	271
„ iodide.....	Hg I_2	454
„ potass. iodide (sol.).....	$\text{HgI}_2 \cdot 2\text{KI}$	786
Metol*	$(\text{C}_6 \text{ H}_4 \text{ OH NHCH}_3)_2 \cdot \text{H}_2 \text{SO}_4$	344
Ortol†	$(\text{C}_6 \text{ H}_4 \text{ OH NHCH}_3)_2 + \text{C}_6 \text{ H}_4$ $(\text{OH})_2$	234
Palladious chloride	Pd Cl_2	177
„ potassium chloride	$\text{K}_2 \text{ Pd Cl}_4$	326
Para-amidophenol	$\text{C}_6 \text{ H}_4 \text{ NH}_2 \text{ OH}$	109
Phenol (see Acid carbolic)		
Platinum per (or bi)chloride.....	$\text{H}_2 \text{ Pt Cl}_6 \cdot 6\text{H}_2\text{O}$	516.4
Potassium, ammonium chromate	$\text{K NH}_4 \text{ Cr O}_4$	173
„ bicarbonate.....	K H CO_3	100
„ bichromate	$\text{K}_2 \text{ Cr}_2 \text{ O}_7$	294
„ boro-tartrate	$\text{C}_2 \text{ H}_2 (\text{OH})_2 (\text{CO}_2)_2 \cdot \text{BOK}$	214
„ bromide	K Br	119
„ carbonate (dry)	$\text{K}_2 \text{ CO}_3$	138

* Metol is the sulphate of mono-methyl-para-amido-phenol.

† Ortol is a mixture of one molecule each of methyl ortho-amido-phenol and hydroquinone.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.		SYMBOL.	EQUIV. WEIGHT.
Potassium	chlorate	$K Cl O_3$	122.5
"	chloride	$K Cl$	74.5
"	chloro-platinate	$K_2 Pt Cl_4$	413.4
"	chromate	$K_2 Cr O_4$	194
"	citrate	$K_3 C_6 H_5 O_7 H_2 O$	342
"	cyanide	$K C N$	65
"	ferricyanide	$K_3 Fe (CN)_6$	329
"	ferrocyanide	$K_4 Fe (CN)_6 3 H_2 O$	422
"	hydrate	$K HO$	56
"	iodide	$K I$	166
"	metabisulphite	$K_2 S_2 O_6$	222
"	nitrate	$K NO_3$	101
"	nitrite	$K NO_2$	85
"	oxalate	$K_2 C_2 O_4 H_2 O$	184
"	percarbonate	$K_2 C_2 O_6$	198
"	perchlorate	$K Cl O_4$	138.5
"	permanganate	$K_2 Mn_2 O_8$	316
"	persulphate	$K_2 S_2 O_8$	270
"	sulphate	$K_2 SO_4$	174
"	sulphocyanide	$K C N S$	97
Pyrocatechin	.....	$C_6 H_4 (OH)_2$	110
Rochelle salt	.....	$K Na C_4 H_4 O_6 4 H_2 O$	282
Schlippe's salt (sodium sulphanti-	.....	
moniate)	.....	$Na_3 Sb S_4 9 H_2 O$	479
Silver, acetate	.....	$Ag C_2 H_3 O_2$	167
"	ammonium nitrate	$Ag NO_3 + 2 NH_3$	204
"	bromide	$Ag Br$	188
"	carbonate	$Ag_2 CO_3$	276
"	chloride	$Ag Cl$	143.5
"	citrate	$Ag C_6 H_5 O_7$	513
"	fluoride	$Ag F 4 H_2 O$	199
"	iodide	$Ag I$	235
"	nitrate	$Ag NO_3$	170
"	nitrite	$Ag NO_2$	154
"	oxalate	$Ag_2 C_2 O_4$	304
"	oxide	$Ag_2 O$	224
"	phosphate	$Ag_3 PO_4$	419
"	sulphate	$Ag_2 SO_4$	312
"	sulphide	$Ag_2 S$	248
"	tartrate	$Ag_2 C_4 H_4 O_6$	363.4
Sodium, acetate	.....	$Na C_2 H_3 O_2 3 H_2 O$	136
"	" (fused)	$Na C_2 H_3 O_2$	102
"	bicarbonate	$Na H CO_3$	84
"	bichromate	$Na_2 Cr_2 O_7 2 H_2 O$	298
"	bisulphite	$Na H SO_3$	104

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Sodium, borate	$\text{Na}_2 \text{B}_4 \text{O}_7 \cdot 10\text{H}_2\text{O}$	382
„ bromide	$\text{Na Br} \cdot 2\text{H}_2\text{O}$	139
„ carbonate (dry).....	$\text{Na}_2 \text{CO}_3$	106
„ carbonate (cryst.)	$\text{Na}_2 \text{CO}_3 \cdot 10\text{H}_2\text{O}$	286
„ chloride	Na Cl	58.5
„ chloro-platinate	$\text{Na}_2 \text{Pt Cl}_6 \cdot 6\text{H}_2\text{O}$	560.4
„ citrate.....	$\text{Na}_3 \text{C}_6 \text{H}_5 \text{O}_7 \cdot 5\frac{1}{2}\text{H}_2\text{O}$	357
„ fluoride	Na F	42
„ hydrate (caustic)	Na OH	40
„ hydrosulphite*	Na H SO_3	88
„ hyposulphite†	$\text{Na}_2 \text{S}_2 \text{O}_3 \cdot 5\text{H}_2\text{O}$	248
„ iodide	Na I	150
„ nitrate	Na NO_3	85
„ nitro-prusside	$\text{Na}_4 \text{Fe}_2 (\text{CN})_{10} (\text{NO})_2 \cdot 4\text{H}_2\text{O}$	600
„ oxalate	$\text{Na}_2 \text{C}_2 \text{O}_4$	134
„ phosphate	$\text{Na}_2 \text{HPO}_4 \cdot 12\text{H}_2\text{O}$	358
„ tribasic phosphate	$\text{Na}_3 \text{PO}_4 \cdot 12\text{H}_2\text{O}$	380
„ sulphate (cryst.)	$\text{Na}_2 \text{SO}_4 \cdot 10\text{H}_2\text{O}$	322
„ sulphide	$\text{Na}_2 \text{S} \cdot 9\text{H}_2\text{O}$	240
„ sulphide (dry)	$\text{Na}_2 \text{SO}_3$	126
„ „ (cryst.)	$\text{Na}_2 \text{SO}_3 \cdot 7\text{H}_2\text{O}$	252
„ tungstate	$\text{Na}_{10} \text{W}_{12} \text{O}_{41} \cdot 28\text{H}_2\text{O}$	379.8
Strontium, bromide	Sr Br_2	247.5
„ chloride (dry)	Sr Cl_2	158.5
„ „ (cryst.)	$\text{Sr Cl}_2 \cdot 2\text{H}_2\text{O}$	194.5
„ • iodide	Sr I_2	341.5
„ nitrate	$\text{Sr} (\text{NO}_3)_2$	211.5
Thiocarbamide	$\text{CS} (\text{NH}_2)_2$	76
Thiosinamine	$\text{CS} (\text{NH}_2) \text{NH C}_3 \text{H}_5$	116
Thymol	$\text{CH}_3 \text{C}_6 \text{H}_3 \text{OH C}_3 \text{H}_7$	150
Tin (Stannous) chloride.....	$\text{Sn Cl}_2 + 2\text{H}_2\text{O}$	225
Uranium, acetate	$\text{UO}_2 (\text{C}_2 \text{H}_3 \text{O}_2)_2 \cdot 2\text{H}_2\text{O}$	426
„ chloride	$\text{UO}_2 \text{Cl}_2$	343
„ nitrate	$\text{UO}_2 (\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$	504
Zinc, sulphate	$\text{Zn SO}_4 \cdot 7\text{H}_2\text{O}$	287

* Called "hyposulphite" by chemists.

† Called "thiosulphate" by chemists.

TABLE OF THE SOLUBILITIES OF THE PRINCIPAL SUBSTANCES USED IN PHOTOGRAPHY.

sol.—soluble; v.s.—very soluble; s.s.—slightly soluble; dec.—decomposed;
insol.—insoluble.

Name.	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Cold.	Boiling		
Acetone .....	..	..	..
„ sulphite	v.s.	..	..	s.s.
Acid, acetic .....	..	..	..
„ benzoic	380	45	27	1 in 2.75 90%
„ boric	29	2.9	3 $\frac{1}{2}$	1 in 28 90%
„ carbolic	15	..	6.6	v.s.
„ chromic (anhydride) ..	6	v.s.	160	sol. with decomp'.
„ citric	$\frac{3}{4}$	$\frac{1}{2}$	130	
„ formic .....	..	..	..
„ gallic	100	0.3	1	1 in 5 90% alcohol 1 in 40 ether

Acetone.—(Sp. gr. .814), boils at 133°F. miscible in all proportions with water, alcohol and ether. 272 gms. dissolve in 100 gms. 20% cane sugar solution at 60°F. A solvent of resin, fats, camphor, pyroxylin and celluloid.

Acetic Acid.—The “glacial” acid, which is that implied in formulæ unless a weaker acid is directed, solidifies about 50°. Its sp. gr. is 1.055; it boils at 245°F. It is a solvent of gelatine, celluloid, pyroxyline, fats, oils, etc., blisters the skin, strongly absorbs water from the air, and is miscible with water, alcohol, ether, chloroform and glycerine in all proportions.

Formic Acid.—A colourless liquid of 1.22 sp. gr. (=100% acid), miscible with water and alcohol. Weaker solutions are:—1.20 (90%); 1.18 (80%); 1.15 (65%); 1.12 (50%) and 1.06 (25%).

Hydroiodic Acid.—A solution of the gas, HI, and obtainable as strong as sp. gr. 2.0 (=96% HI). Solution of sp. gr. 1.7 contains about 52%; sp. gr. 1.5, about 43%.

Hydrobromic Acid.—A solution of the gas, HBr., in water. The strongest solution has sp. gr. of 1.78 (=82%); sol. of 1.495 sp. gr. contains 48% HBr.; 1.38, 40%; 1.208, 25%.

Hydrochloric Acid.—A solution of the gas, HCl, in water. The commercial strongest acid has sp. gr. 1.21, and contains about 40% HCl. Impure acid is sold as “spirits of salts.”

Hydrocyanic Acid (=Prussic Acid).—The strength of the official acid of the British Pharmacopœia is 2%. A 10% acid is obtainable in the chemical trade. Both are the most deadly and dangerous poisons.

Hydrofluoric Acid is a strongly fuming solution of the gas HF.; it is sold of strengths 40% and 55% HF.

Lactic Acid is sold as a colourless syrupy liquid, miscible with water or alcohol. Sp. gr. 1.21. A weaker acid is also sold commercially containing 50% acid.

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Cold.	Boiling		
Acid oxalic	9.5	.3	10½	
„ phosphoric .....	..	..	..
„ picric	100	..	1	1 in 10 90%, also in ether
„ pyrogallie.....	2½	v.s.	44	sol. also in ether, not in chloroform
„ salicylic	500	12½	½	1 in 35, 1 in 2 in ether
„ tannic .....	.5	..	20	1 in .6, nearly insol. in ether
„ tartaric.....	¾	1	132	
Aduroi .....	..	..	..
Agar-agar .....	..	..	..
Albumen .....	..	..	..
Alum, ammonia	8.3	.24	12	insoluble
„ chrome	6	dec.	16	
„ iron ammonia	3	dec.	33	insoluble
„ potash	10	v.s.	9.6	insoluble
Aluminium, chloride	¼	v.s.	400	soluble
„ sulphate	3	1.1	35	

Nitric Acid.—Strongly corrosive liquid of 1.42 sp. gr. (=71% HNO_3); soluble in water; oxidises alcohol and other organic solvents.

Phosphoric Acid.—Sold as syrupy liquid, that of 1.75 sp. gr. (=about 90% acid), being intended when “phosphoric acid” is prescribed in formulæ.

Sulphuric Acid.—The commercial strong acid is a thick corrosive liquid of 1.84 sp. gr. (=98% H_2SO_4). It absorbs water rapidly from the air, and, mixed with water, great heat is developed. The acid should always be added to water—not *vice versa*.

Sulphurous Acid.—Solution in water of the gas SO_2 ; saturated solution of 1.046 is equivalent to 9.5% H_2SO_3 , but soon loses strength.

Albumen.—On heating the cold solution to 160°F. the albumen separates in insoluble form. Alcohol similarly coagulates albumen.

Methyl Alcohol (sp. gr. .814).—The chief constituent of crude “wood spirit,” or wood naphtha, in which is usually 10% of acetone.

Ethyl Alcohol forms “absolute alcohol” (sp. gr. .830 to .834), which contains from 2 to 5% water. Alcohol containing 16% water is “rectified spirit.” “Methylated” spirit consists of rectified spirit plus 10% crude wood spirit and 1% mineral naphtha, the latter precipitating as a milkiness on addition of water. These various forms of alcohol mix with water, which can be abstracted with dry potassium carbonate.

Aluminium Chloride.—100 gms. saturated solution (sp. gr., 1.35) contains 41.1 gms. aluminium chloride.

TABLES OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Cold.	Boiling		
Aluminium, sulphocyanide	..	..	..
Amidol	4	v.s.	24	less sol. in alc. & eth.
Ammonium, bichromate..	5	$\frac{1}{2}$	20	1 in 31 absolute alc.
„ bromide	1.4	v.s.	72	
„ carbonate ..	4	dec.	25	
„ chloride	3	1.4	35	
„ citrate	$\frac{1}{2}$	v.s.	200	
„ iodide .....	.6	v.s.	165	1 in 4 alc., s.s. in ether
„ molybdate ..	$2\frac{1}{2}$	dec.	40	
„ nitrate	$\frac{1}{2}$	v.s.	200	
„ oxalate	23	2.4	4.3	sol.
„ persulphate	$1\frac{1}{2}$	dec.	65	
„ (hydro) sulphide	..	..	..
„ sulphocyanide	6	v.s.	160	v.s.
„ vanadate	s.s.	v.s.	..	
Amyl, acetate .....	..	..	..
„ alcohol .....	..	..	..
Aniline .....	..	..	..
Antimony sulphide	insol	..	..
Aurantia	s.s.	..	..	v.s.; s.s. in ether
Aurine	s.s.	..	..	sol.; also in ether
Barium bromide .....	.75	.5	133	v.s. in benzole
„ chloride	2.4	1.3	42	insol.
„ iodide	$\frac{1}{2}$	v.s.	200	1 in 20 alcohol
„ nitrate	12	3.1	8	insol.
Bromine	31	..	3.2	
Cadmium, bromide .....	.94	v.s.	106	1 in 3 alc., 1 in 250 eth.
„ ammonium bromide	.7	v.s.	137	
„ chloride .....	.71	.67	140	1 in 8 alcohol
„ iodide	1.08	.75	93	1 in 1 alc.; 1 in 3-6 eth.
Calcium, chloride (cryst)	$\frac{1}{2}$	v.s.	400	
„ (fused)	1.4	.65	70	
„ sulphate	380	450	3	
„ hydroxide	700	1.300	137	
Ceric sulphate	12	200	8.3	
Chloral hydrate	$\frac{1}{2}$	..	400	1 in 1/5 90%, 1 in 50 carbon bisulphide.

Aluminium Sulphocyanide is purchased as a reddish solution of 1.16 sp. gr.

Ammonium Sulphide is sold as a deep yellow solution containing also polysulphides.

Amyl Acetate.—Liquid of sp. gr. .876, miscible with alcohol and ether, but not with water. A solvent of fats, oils, resin, pyroxyline and celluloid.

Amyl Alcohol, the chief constituent of fusel oil, is not miscible with water.

Aniline (sp. gr. 1.036) is freely miscible with alcohol or ether, but only very slightly with water. It boils at 356° F. and coagulates albumen.

TABLES OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Cold.	Boiling.		
Copper bromide.....	v.s.	v.s.	..	v.s.; also in ether.
„ chloride.....	0.83	v.s.	121	
„ sulphate.....	2½	½	40	
Cyanine	s.s.	[cohol or ether. nearly insol. in al- insol. in ether.
Diamidophenol	sol.	..	..
Edinol	sol.	..	..
Eikonogen	25	..	42	
Eosine	sol.	..	..
Ether	12	..	8	s.s.
Erythrosine	s.s.	..	..
Glycerine.....	..	..	..
Glycin	sol.; also in carbon bisulphide
Gold, chloride.....	v.s.	v.s.	..	
Hydroquinone	17	..	6	
Iodine	insol.	insol.	..	
IRON				
Ferric chloride (lump) ..	v.s.	v.s.	..	
„ „ (dry) ....	.63	v.s.	160
„ ammonium citrate ..	4	..	25	
„ „ (brown)* ..	..	..	..
„ „ (green)† ..	..	..	..
„ oxalate .....	..	..	..
„ ammonium oxalate ..	2.1	..	.48	
„ potassium „ ..	15	.85	6.6	
„ sodium „ ..	1.69	0.55	60	
Ferrous chloride (dry) .	2	v.s.	50	insol.
„ „ (cryst.) ..	.68	v.s.	147	
„ oxalate	4500	3800	..	
„ potass. oxalate ..	..	..	..
„ sulphate	1.43	0.27	70	
„ am. sulphate ..	3	..	33	
Lead, acetate	1½	0.5	66	
Lead, nitrate	2	0.7	50	

Ether (called also "sulphuric ether") is very volatile and inflammable. Boils at 95° F., sp. gr. .722.

Formaline.—A commercial strong solution (40%) of formic aldehyde, CH₂O.

Gelatine becomes swollen in cold water and dissolves in hot. Dissolved in the cold by oxalic, acetic, hydrochloric, and nitric acids, barium chloride and chlora hydrate. Precipitated from its solution in water by alcohol.

Glycerine.—Miscible with water or alcohol. Sp. gr. 1.265.

Iodine dissolves freely also in carbon bisulphide or potassium iodide solution.

Ferric Oxalate is very soluble, over 20%, it is partially reduced to ferrous oxalate on heating the solution to 212° F.

Seven parts of ferrous sulphate correspond to 10 parts ferrous ammonium sulphate. * 21.7-22.4% iron. † 14 to 15% iron.

TABLES OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Cold.	Boiling		
Lithia, caustic	s.s.	..	..
Lithium, bromide	·7	·4	143	
" carbonate	72	138	1·3	v.s.
" chloride	1½	·8	80	
" iodide	·61	·2	164	v.s.
Magnesium, chloride (dry) ..	1·7	1½	60	v.s.
" sulphate	1	·15	100	
Manganese, sulphate	·8	1	120	
Mercury, bichloride	16	1·8	6·3	insol. in absolute alc.
" iodide	150	..	·66	1 in 4·90%
Metol	sol.	..	..
Ortol	sol.	..	..	s.s. ; also in ether
Para amido-phenol	10	..	10	
Phenol (<i>see</i> acid carbohc)				1 in 22
Potassium, bicarbonate ..	4	dec.	25	
" bichromate ..	10	1	10	
" borotartrate ..	¾	v.s.	135	
" bromide	1½	1	65	
" carbonate (dry) ..	·9	·64	112	1 in 750
" chlorate	17	2	6	insol.
" chloride	3	1·75	33	insol.
" chloroplatinite ..	6	v.s.	17	
" chromate	2	1·2	50	insol
" citrate	·6	v.s.	166	insol.
" cyanide	·8	v.s.	122	v.s.
" ferricyanide ..	2½	1·3	40	1 in 9
" ferrocyanide ..	3·4	2	29	
" hydrate	½	v.s.	200	insol. ; insol. in eth.
" iodide	·7	½	140	sol.
" metabisulphite ..	sol.	dec.	..	1 in 16, 90%
" nitrate	3½	·4	28	
" nitrite	1	v.s.	100	
" oxalate	3	v.s.	33	insol.
" percarbonate ..	15	dec.	6·5	
" perchlorate ..	100	5	1	
" permanganate ..	16	..	6·25	
" persulphate ..	50	dec.	2	
" sulphocyanide ..	·46	v.s.	220	insol. in absolute alc.
" acid sulphate ..	2	·8	50	
Pyrocatechin	1½	v.s.	80	
Rochelle salt	1½	v.s.	66	
Schlippe's salt	3	v.s.	33	

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water.		100 parts water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Co'd.	Boiling		
Silver, acetate	100	..	1	
„ carbonate	insol.	..	..
„ chlorate	5	2	20	
„ citrate ¹	insol.	..	..
„ cyanide	insol.	..	..
„ fluoride ²	v.s.	v.s.	..	
„ nitrate	0.44	0.1	227	1 in 26, 90%
„ nitrite	s.s.	..	..
„ sulphate	87	..	1.15	
„ sulphocyanide ..	insol.	..	..
„ tartrate	insol.	..	..
Sodium, acetate	2.8	v.s.	36	1 in 50, 90%; insol. in
„ bicarbonate	11.3	dec.	8.8	[ether]
„ bichromate	1	0.6	100	
„ bisulphite	v.s.	..	..
„ borate	12½	½	8	
„ bromide	1.1	0.9	90	1 in 15
„ carbonate (dry) ..	6	2.2	16.2	
„ „ (cryst.)	1.56	v.s.	63.2	
„ chloride	3	2½	35	
„ chloroplatinate ..	sol.	..	..
„ citrate	sol.	..	..	s.s.
„ fluoride	25	..	4	
„ hydrate (caustic) ..	v.s.	v.s.	..	
„ hyposulphite ..	0.6	v.s.	170	insol.
„ iodide	0.6	0.4	166	
„ nitrate	1.1	0.6	85	
„ oxalate	35	..	3	
„ phosphate	6.7	1	15	
„ sulphide	v.s.	v.s.	..	
„ sulphite (cryst) ..	2.2	1	45	
„ „ (dry) ..	4	..	25	
„ tri-basic phosphate	0.5	v.s.	20	
„ tungstate	8 to 12	..	..	insol.
„ (meta) vanadate ..	½	v.s.	200	
Strontium, bromide	1.01	½	100	1 in 30, 90%
„ chloride	1.96	1	51	
„ „ (cryst.)	1.33	0.6	75	
„ iodide	0.56	0.25	18	
„ nitrate	1.41	1	71	
Thiocarbamide	11	v.s.	9	v.s. also in ether

1. Readily soluble in ammonia and hypo.

2. AgF.4H₂O is almost as soluble as calcium chloride.

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in -- parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Cold.	Boiling		
Thiosinamine	17	..	6	1 in 2 90 %; also in eth.
Thymol	330	..	0.3	1 in 3.75 90%; also in [ether.
Tin (stannous), chloride..	1½	v.s.	66	
Uranium, acetate	v.s.	v.s.	..	
„ chloride	v.s.	v.s.	..	
„ nitrate	½	v.s.	200	
Zinc, sulphate	0.62	0 15	161	

PERCENTAGE OF REAL AMMONIA IN SOLUTIONS OF DIFFERENT DENSITIES AT 14° CENTIGRADE.—CARIUS.

Specific Gravity.	Per-centage Ammonia	Specific Gravity.	Per-centage Ammonia	Specific Gravity	Per-centage Ammonia	Specific Gravity.	Per-centage Ammonia
0.8844	36.0	0.9052	27.0	0.9314	18.0	0.9631	9.0
0.8864	35.0	0.9078	26.0	0.9347	17.0	0.9670	8.0
0.8885	34.0	0.9106	25.0	0.9380	16.0	0.9709	7.0
0.8907	33.0	0.9133	24.0	0.9414	15.0	0.9749	6.0
0.8929	32.0	0.9162	23.0	0.9449	14.0	0.9790	5.0
0.8953	31.0	0.9191	22.0	0.9484	13.0	0.9831	4.0
0.8976	30.0	0.9221	21.0	0.9520	12.0	0.9873	3.0
0.9001	29.0	0.9251	20.0	0.9556	11.0	0.9915	2.0
0.9026	28.0	0.9283	19.0	0.9503	10.0	0.9959	1.0

INDICATORS

(I.e., Colour Tests for Alkalies and Acids).

	Acid.	Alkaline.	In presence of Carbon Dioxide.
Litmus	Bright red	Blue	Reddish purple
Cochineal	Yellow	Reddish violet	Not affected
Methyl orange ..	Red	Yellow brown	Not affected
Phenol-phthalein	Colourless	Intense red	Useless

REACTION OF SUBSTANCES TO VARIOUS INDICATORS.

Substance.	Litmus.	Methyl Orange.	Phenol- phthalein
Alum	acid	neutral	acid
Borax	alkaline	alkaline	neutral
Potass metabisulphite	acid	neutral	acid
Potass oxalate	neutral	neutral	neutral
Rochelle salt	neutral	neutral	neutral
Silver nitrate	acid	neutral	acid
Sodium bicarbonate	alkaline	alkaline	neutral
Sodium citrate	alkaline	alkaline	neutral
Sodium bisulphite	acid	neutral	acid
Sodium sulphite	alkaline	alkaline	neutral
Sodium phosphate ..	neutral	alkaline	neutral

TABLE OF POISONS AND ANTIDOTES. Compiled by J. V. ELSDEN.

Poisons.	Remarks.	Characteristic Symptoms.	Antidote.
Vegetable Acids.			
Caustic Alkalies.			
Oxalic Acid, including Potassium Oxalate, Ammonia Potash Soda, Mercuric Chloride	1 drachm is the smallest fatal dose known. Vapour of ammonia may cause inflammation of the lungs. 3 grains the smallest known fatal dose.	Hot burning sensation in throat and stomach; vomiting, cramps, and numbness. Swelling of tongue, mouth, and fauces; often followed by stricture of the œsophagus. Acrid, metallic taste, constriction and burning in throat and stomach, followed by nausea and vomiting.	Chalk, whiting, or magnesia suspended in water. Plaster or mortar can be used in emergency. Vinegar and water.
Acetate of Lead	The sub-acetate is still more poisonous	Constriction in the throat and at pit of stomach; crampy pains and stiffness of abdomen; blue line round the gums.	White and yolk of raw eggs with milk. In emergency, flour paste may be used.
Cyanide of Potassium	a. Taken internally, 3 grs. fatal. b. Applied to wounds and abrasures of the skin.	Insensibility, slow gasping respiration, dilated pupils, and spasmotic closure of the jaws. Smarting sensation.	No certain remedy; cold affusion over the head and neck most efficacious.
Bichromate of Potassium	a. Taken internally. b. Applied to slight abrasions of the skin.	Irritant pain in stomach and vomiting. Produces troublesome sores and ulcers.	Sulphate of iron should be applied immediately. Emetics and magnesia, or chalk.
Nitrate of Silver			
Nitric Acid	2 drachms have been fatal. Inhalation of the fumes has also been fatal.	Corrosion of windpipe and violent inflammation.	Common salt to be given immediately, followed by emetics.
Hydrochloric Acid	1 ounce has caused death.		Bicarbonate of soda, or carbonate of magnesia or chalk, plaster of the apartment beaten up in water.
Sulphuric Acid	1 drachm has been fatal. Acetic Acid, concentrated, has as powerful an effect as the mineral acids.		
Iodine	Variable in its action; 3 grains have been fatal.	Acrid taste, tightness about the throat, vomiting.	Vomiting should be encouraged and gruel, arrowroot and starch given freely.
Ether	When inhaled	Effects similar to chloroform	Cold affusion and artificial respiration.
Pyrogallol	2 grains sufficient to kill a dog.	Resembles phosphorus poisoning.	No certain remedy. Speedy emetic desirable.
Concentrated Mineral Acids.			

THERMOMETRIC TABLES,

Showing the Assimilation of the Thermometers in Use throughout the World.

Centigrade.	Réaumur.	Fahrenheit.	Centigrade.	Réaumur.	Fahrenheit.
100	80 0	212·0	49	39·2	120·2
99	79·2	210·2	48	38·4	118·4
98	78·4	208·4	47	37·6	116·6
97	77·6	206·6	46	36·8	114·8
96	76·8	204·8	45	36·0	113·0
95	76·0	203·0	44	35·2	111·2
94	75·2	201·2	43	34·4	109·4
93	74·4	199·4	42	33·6	107·6
92	73·6	197·6	41	32·8	105·8
91	72·8	195·8	40	32·0	104·0
90	72·0	194·0	39	31·2	102·2
89	71·2	192·2	38	30·4	100·4
88	70·4	190·4	37	29·6	98·6
87	69·6	188·6	36	28·8	96·8
86	68·8	186·8	35	28·0	95·0
85	68·0	185·0	34	27·2	93·2
84	67·2	183·2	33	26·4	91·4
83	66·4	181·4	32	25·6	89·6
82	65·6	179·6	31	24·8	87·8
81	64·8	177·8	30	24·0	86·0
80	64·0	176·0	29	23·2	84·2
79	63·2	174·2	28	22·4	82·4
78	62·4	172·4	27	21·6	80·6
77	61·6	170·6	26	20·8	78·8
76	60·8	168·8	25	20·0	77·0
75	60·0	167·0	24	19·2	75·2
74	59·2	165·2	23	18·4	73·4
73	58·4	163·4	22	17·6	71·6
72	57·6	161·6	21	16·8	69·8
71	56·8	159·8	20	16·0	68·0
70	56·0	158·0	19	15·2	66·2
69	55·2	156·2	18	14·4	64·4
68	54·4	154·4	17	13·6	62·6
67	53·6	152·6	16	12·8	60·8
66	52·8	150·8	15	12·0	59·0
65	52·0	149·0	14	11·2	57·2
64	51·2	147·2	13	10·4	55·4
63	50·4	145·4	12	9·6	53·6
62	49·6	143·6	11	8·8	51·8
61	48·8	141·8	10	8·0	50·0
60	48·0	140·0	9	7·2	48·2
59	47·2	138·2	8	6·4	46·4
58	46·4	136·4	7	5·6	44·6
57	45·6	134·6	6	4·8	42·8
56	44·8	132·8	5	4·0	41·0
55	44·0	131·0	4	3·2	39·2
54	43·2	129·2	3	2·4	37·4
53	42·4	127·4	2	1·6	35·6
52	41·6	125·6	1	0·8	33·8
51	40·8	123·8	0	0·0	32·0
50	40·0	122·0			

THERMOMETRIC RULES.

The following rules for the rapid conversion of degrees in one system into another will be found useful:—

To Convert Centigrade into Fahrenheit :

Degrees Centigrade $\times 9 \div 5 + 32$.

Ex.— 80° C. $\times 9 \div 5 = 144 \div 5 = 28.8 + 32 = 176^{\circ}$ F.

To Convert Centigrade into Réaumur :

Degrees Centigrade $\times 4 \div 5$.

Ex.— 60° C. $\times 4 \div 5 = 48^{\circ}$ R.

To Convert Fahrenheit into Centigrade :

(Degrees Fahrenheit $- 32$) $\times 5 \div 9$.

Ex.— 100° F. $- 32 = 68 \times 5 \div 9 = 37.8$ C.

To Convert Fahrenheit into Réaumur :

(Degrees Fahrenheit $- 32$) $\div 9 \times 4$.

Ex.— 95° F. $- 32 = 63 \div 9 \times 4 = 28^{\circ}$ R.

To Convert Réaumur into Centigrade

Degrees Réaumur $\times 5 \div 4$.

Ex.— 80° R. $\times 5 \div 4 = 100^{\circ}$ C.

To Convert Réaumur into Fahrenheit

Degrees Réaumur $\times 9 \div 4 + 32$.

Ex.— 16° R. $\times 9 \div 4 = 36 + 32 = 68^{\circ}$ F.

ORTHOCHROMATIC DATA.

DISTRIBUTION OF THE COLOURS IN THE SPECTRUM.

(ACCORDING TO LISTING.)

Wave length.			Wave length.		
BROWN	Limit	819.8	CYAN BLUE..	Limit	491.9
	Middle	768.6		Middle	473.0
RED..	Limit	723.4	INDIGO	Limit	455.5
	Middle	683.2		Middle	439.2
ORANGE	Limit	647.2	VIOLET	Limit	424.0
	Middle	614.9		Middle	409.9
YELLOW	Limit	585.6	LAVENDER..	Limit	396.7
	Middle	559.0		Middle	384.3
GREEN	Limit	534.7		Limit	372.6
	Middle	512.4			

WAVE LENGTHS OF BRIGHT LINES OF ELEMENTS USED IN PLOTTING OUT THE SPECTRUM.

(IN TEN-MILLIONTHS OF A MILLIMETRE ANGSTROM UNITS.)

TABLE I.

Name of line.	Colour.	Salts used.	Wave lengths = λ
Lithium	Red	Lithium chloride or nitrate ..	6705
Lithium	Orange	Lithium chloride or nitrate ..	6102
D	Orange	Sodium chloride or bicarbonate	5893
" Little b "	Green	Magnesium ribbon ..	5183
Strontium	Blue	Strontium chloride or metal ..	4607
Calcium	Blue	Calcium nitrate or chloride ..	4227
Potassium	Violet	Potassium chloride	4080

Table I. has been drawn up so as to enable any one with nothing more than an ordinary Bunsen gas burner to construct a chart, by means of which the position of any Fraunhofer line in the spectrum may be determined with sufficient accuracy for all photographic purposes. The salts should be dissolved in distilled water so as to form a saturated solution, a narrow loop of copper or iron wire should be wound with fibrous asbestos, and this repeatedly heated in the Bunsen and allowed to cool.

TABLE II.

C	Red	Hydrogen tube	..	..	6563
"Little b"	Green	Magnesium rod	..	..	5183
F	Bluish-green	Hydrogen tube	..	..	4861
Magnesium	Blue	Magnesium rod	..	..	4481
G	Blue	Hydrogen tube	..	..	4308
"Little h"	Blue	Hydrogen tube	..	..	4102

Table II. will give the data, most easily obtained if a small induction coil is used. A small coil, giving a fat $\frac{1}{2}$ or $\frac{3}{4}$ in. spark, and actuated by three bichromate bottles will suffice to show the lines in this table. The hydrogen tube is, of course, of the well-known Plucker or Salet form. The magnesium may be used in twisted spirals of ribbon, but preferably in rod form, and the rods should be filed to comparatively sharp points. The constricted portion of the vacuum tube and the points of the magnesium rod should be placed parallel to and not at right angles to the slit.

EXPOSURE TABLES.

The following table, based on that of Burton, gives a rough idea of the exposures for various subjects and diaphragms under the following conditions:—

1. Best lighting; midday sunshine in May, June, and July.
2. With the most rapid commercial plates. See below for factors applying to other conditions.

F/ No.	Average Subject with objects in Fore-ground. Street Scenes. Outdoor Figure Studies.	Landscapes with Light Foreground, Lake, River, and Beach Scenes.	Sea Clouds and Sky.	Subjects with Extra Heavy Foreground, e.g., Dark Trees, Doorways, Groups.	Under Trees, Wood Avenues, Glades, etc.	Portrait in Average Well-lighted Room.
<i>f/4</i>	1/250	1/500	—	1/120	1/20	1/8
<i>f/4.5</i>	1/200	1/400	—	1/100	1/15	1/7
<i>f/5.6</i>	1/130	1/250	—	1/64	1/10	1/4
<i>f/6.3</i>	1/100	1/200	1/1000	1/50	1/8	1/3
<i>f/7</i>	1/80	1/150	1/800	1/40	1/7	2/5
<i>f/8</i>	1/64	1/120	1/600	1/30	1/5	1/2
<i>f/11</i>	1/30	1/60	1/300	1/15	1/2	1
<i>f/16</i>	1/15	1/30	1/150	1/8	1	2
<i>f/22</i>	1/8	1/15	1/80	1/4	2	4
<i>f/32</i>	1/4	1/8	1/40	1/2	4	8
<i>f/45</i>	1/2	1/4	1/20	1	8	16
<i>f/64</i>	1	1/2	1/10	2	16	30

PINHOLE EXPOSURES.

(WATKINS-POWER NUMBERS.*)

W. P. No.	Diameter.		Nearest Needle Size.	Good Working Distance.
	Inch.	Inch		
1	0.160	$\frac{1}{7}$	—	—
2	0.080	$\frac{1}{13}$	—	—
3	0.053	$\frac{1}{19}$	1	40
4	0.040	$\frac{1}{25}$	4	20
5	0.032	$\frac{1}{31}$	5	14
6	0.027	$\frac{1}{38}$	7	10
7	0.023	$\frac{1}{43}$	8	8
8	0.020	$\frac{1}{52}$	10	5

Rule for use of W.P. No. in Column 1.—Multiply W.P. No. of aperture by its working distance from plate. Use the result as the *f*/No. in calculating exposure by meter, tables or other means. Whatever the calculated result is in seconds or fractions of a second, expose that number of minutes or fractions of a minute. Example.—W.P. 6 at 8 inches calculate as *f*/48.

*The principle of this system will be understood from a consideration of an example of focal aperture:—A $\frac{1}{8}$ -inch aperture at 9 inches = *f*/36. If every second on the actinometer is to be reckoned a minute, the aperture must be one-sixtieth the *area*, that is the diameter must be divided by $\sqrt{60}$ or, near enough, by $\sqrt{64} = 8$. Therefore, an aperture of $\frac{1}{8} \div 8 = \frac{1}{64}$ inch diameter = *f*/36 when minutes are given instead of seconds. Therefore, reasoning backwards, a pinhole of $\frac{1}{32}$ -inch diameter is called No. 4 ($32 \div 8$). Similarly one of half the diameter is No 8, and so on. Mr. Watkins, in order to allow for the exposure in excess of the theoretical which is needed in pinhole photography, calculates minutes as seconds at $\frac{1}{60}$ instead of $\frac{1}{36}$, the *area* of aperture, and therefore his so-called W.P. (Watkins-Power number) is obtained by dividing the denominator of the fraction which expresses the diameter of the pinhole by 6.3 instead of 8. Thus, in the case of a $\frac{1}{32}$ -diameter hole, $32 \div 6.3 = 6.2$, or, near enough, W.P. No. is 6.

TABLE OF COMPARATIVE PLATE SPEED NUMBERS.

H & D.	Watkins P No.	Wynne F. No.	H & D.	Watkins P No.	Wynne F No.
10	15	24	220	323	114
20	30	28	240	352	120
40	60	49	260	382	124
80	120	69	280	412	129
100	147	77	300	441	134
120	176	84	320	470	138
140	206	91	340	500	142
160	235	103	380	558	150
200	294	109	400	588	154

The above Watkins and Wynne numbers are equivalent to the H and D, only when the latter is determined in accordance with the directions of Hurter and Driffeld, that is with pyro-soda developer and using the straight portion only of the density curve.

To convert H and D into Watkins:—Multiply H and D by 50 and divide by 34. For all practical purposes the Watkins P number is $1\frac{1}{2}$ times H and D.

To convert Watkins into Wynne F. Nos.:—Extract the square root and multiply by 6.4.

The above methods have been approved by the Watkins Meter Company and the Infallible Exposure Meter Company with reference to "Wratten" plates, but the comparisons here given may not hold good with every other plate.

SHUTTER SPEEDS FOR MOVING OBJECTS.

From the "Wellcome Exposure Record and Diary."

The formula and table given below indicate the shutter speeds necessary to secure negatives sufficiently sharp for direct printing. For enlarging it is better to give $\frac{1}{4}$ to $\frac{1}{2}$ these exposures, or to work further from the object. *The figures are no guide to what is the correct exposure for the plate.*

If D = distance of object in feet, F = focal length of lens, S = speed of object in feet per second, and E = exposure for an object moving across the field of view, then

$$E = \frac{D}{100 F \times S}$$

The following table gives in round figures the shutter speeds necessary for various moving objects, using the ordinary quarter plate lens of about 5 in. focus. The column A is for objects moving directly towards the operator, B for objects moving obliquely towards or from the camera, that marked C for objects moving directly across the field of view.

Distance of Object, 25 ft., unless otherwise stated.	A.	B.	C.
Street groups (no rapid motion)	1/5 to 1/10		
Pedestrians (two miles per hour)	1/20	1/40	1/60
Animals grazing	1/30	1/60	1/90
Pedestrians (three miles per hour)	1/40	1/80	1/120
Pedestrians (four miles per hour)	1/60	1/120	1/180
Vehicles (six miles per hour)	1/80	1/150	1/250
Vehicles (eight miles per hour)	1/160	1/300	1/500
Cyclists and trotting horses	1/240	1/500	1/700
Foot races and sports	—	1/600	1/800
Divers	1/300	1/750	1/900
Cycle races, horse galloping	1/60	1/120	1/180
Yachts (10 knots per hour) at 50 ft. ..	1/120	1/240	1/360
Steamers (20 knots per hour) at 50 ft. ..	1/150	1/300	1/450
Trains (30 miles per hour) at 50 ft. ..	1/300	1/600	1/900

At 50 ft. the exposure may be double that at 25 ft.

At 100 ft. the exposure may be double that at 50 ft.

OPTICAL CALCULATIONS.

Optical Rules and Equations.

CONJUGATE FOCI.

Let f = focal length.

u = nodal distance of object measured from node of admission.

v = nodal distance of image measured from node of emission.

d = extra focal distance of object measured from *front principal focus*.

x = extra focal distance of image measured from *back principal focus*.

R = linear ratio of $\frac{\text{object}}{\text{image}}$. This is greater than unity when reducing; less than unity when enlarging.

$$\text{Then } u = \frac{vf}{v-f} = Rv = (R+1)f.$$

$$v = \frac{uf}{u-f} = \frac{u}{R} = \left(\frac{1}{R} + 1\right)f.$$

$$d = u-f = \frac{f^2}{x} = Rf.$$

$$x = v-f = \frac{f^2}{d} = \frac{f}{R}.$$

Definitions.—Principal Focus.—This is the focus to which the lens brings parallel rays emanating from a point at an infinite distance. If we focus directly on a star the image is at the back principal focus. A corresponding point in front of the lens at the position the image would occupy if the lens were reversed is the front principal focus.

Node.—If we focus on a distant star the image will remain stationary when the lens is rotated through a small arc in any direction about one fixed point. This point is the node of emission. The node of admission is a corresponding point that will have the same properties if the lens is reversed.

A distance measured from a node is termed a nodal distance.

A distance measured from a principal focus is an extrafocal distance. In general it is most convenient to measure distances in this way.

The nodal distance of back principal focus from node of emission is equal to that of the front principal focus from node of admission, and is called the focal length of the lens.

SCALE OF IMAGE.

Let r = ratio of $\frac{\text{image}}{\text{object}}$

$$\text{Then } r = \frac{1}{R} = \frac{v}{u} = \frac{f}{d} = \frac{r}{f}$$

CALCULATION OF FOCAL LENGTH.

Various useful methods can be based on following equations

$$f = \frac{vu}{v+u} = \frac{u}{R+1} = \sqrt{d \cdot r} = Rr = \frac{d}{R}$$

COMBINING LENSES.

Let f_1 and f_2 = focal lengths of respective lenses.

s = separation measured from node of emission of front lens to node of admission of back lens (termed nodal separation).

F = focal length of combination.

$$\text{Then } F = \frac{f_1 f_2}{f_1 + f_2 - s}$$

If one lens is a symmetrical doublet and the other a supplementary lens placed *inside* the doublet, then, approximately, s = half the extreme outside length of the doublet. The value of s should not be neglected unless very small.

EXPOSURE.

In exposure we consider effective aperture, and the diameter of the effective aperture is that of the largest parallel beam of light that can enter and pass through the objective.

Let $e = v$ divided by diameter of effective aperture
= so-called "ratio number" of aperture.

f , r , and v represent same quantities as before.

$$\begin{aligned} \text{Then } \frac{v}{e} &= \text{diameter of effective aperture} \\ &= \frac{f}{e} \text{ when object is distant.} \end{aligned}$$

Exposure always varies inversely with $\left(\frac{v}{e}\right)$

With any one lens it varies directly in proportion to the value of e^2 , or of v^2 , or of $(r + 1)^2$, if either the stop or the scale is altered.

With different lenses with apertures of same diameter exposure varies directly with f^2 , provided images of the same size are produced from near objects, as in copying. If images of different sizes are produced exposure varies directly with f^2 , *only* when focussing on infinity. In all other cases the value of $\left(\frac{v}{c}\right)^2$ must be determined to compare relative exposures.

Exposure is always the same so long as the value of e is the same, however much other factors may be varied.

DEPTH OF FIELD.

Depth of field is governed by angular aperture, which is a measure of the angle at the apex of the cone of light reaching the plate when focussing on an infinitely distant point of light. The diameter of the angular aperture is the diameter of the base of the cone when its height is made equal to the focal length. Depth is often calculated on effective aperture; this introduces small errors that are very generally ignored.

Let a = focal length divided by diameter of angular aperture.

c = diameter of circle of confusion. Usually taken as 0.01 inch, but for critical definition 0.005 is necessary.

H = hyperfocal distance. See definition below.

$$\text{Then } H = \frac{f^2}{ac} = \frac{100f^2}{a} \text{ when } c = 0.01 \text{ inch,}$$

measuring all distances from node of admission.

If we focus on infinity the nearest object in focus is at a distance = H . A table of various values of H will be found later in this volume

If we focus on a distance equal to $H + f$, all objects are in focus from $\frac{H+f}{2}$ up to infinity. This is the maximum amount of depth possible.

If we focus on a point at a distance u the distance of nearest object in focus

$$= \frac{Hu}{H+u-f} = \frac{Hu}{H+d}$$

and the distance of farthest object in focus

$$= \frac{Hu}{H-u+f} = \frac{Hu}{H-d}$$

When f is small compared with u it can be disregarded, and u and d can be considered equal, while distances can be measured either from the node or the principal focus.

Very approximately, when we focus on a distance equal to $\frac{H}{n}$ depth extends from $\frac{H}{n+1}$ to $\frac{H}{n-1}$

If an image produced with a lens of focal length f and with aperture of f /number a is enlarged n times the result is equivalent, both as regards size and depth, to one produced directly with a lens of focal length nf and aperture f number na , that is, an aperture of the same diameter.

To produce the same depth with two different lenses the aperture f numbers must vary in proportion with the squares of the focal lengths.

PERSPECTIVE

is controlled, entirely by distance of object from entrance pupil of lens. The entrance pupil is the image of the stop aperture seen through the front lens. If the lens is rotated about the centre of the pupil, the stop appears to remain stationary. In a landscape lens the pupil is the stop. In a symmetrical doublet it is the node of admission. In a telephoto lens it is the node of admission of the front combination, not that of the entire objective.

The proper viewing distance for the print is equal to v , excepting in the cases considered below.

CORRECTION FOR INCONSTANCY OF APERTURE.

With many lenses the aperture varies according to the side of the lens that it is measured upon, and in such cases it varies in diameter with the distance of the object, or is inconstant. All preceding rules and formulæ assume it to be constant, hence the results are in error for near objects. They can, however, be corrected by the following method. The correction for exposure is important when such a lens is used for enlarging. See table of "Relative Exposures for Varying Proportions of Image to the Original."

Let y = distance between entrance pupil and node of admission. If pupil is in front of node y is positive; if behind node y is negative.

The depth is corrected by multiplying results obtained by ordinary formulæ by $1 + \frac{y}{u}$ Exposure by multiplying by $\left(1 + \frac{y}{u}\right)^2$ Viewing distance = $v \left(1 + \frac{y}{u}\right)$ Perspective varies with value of $u - y$.

When object is distant $1 + \frac{y}{u} = 1$ therefore no correction is required. With constant lenses $y = 0$.

The value of y can be measured directly by taking advantage of the facts that, with the objective reversed, the image is stationary when the objective is rotated about its node of admission; and that the apparent stop aperture seen through the front combination is stationary when the objective is rotated about the centre of the entrance pupil.

The telephoto lens is inconstant, but by adopting the usual magnification method of making calculations, all above corrections are allowed for. If, however, we treat the telephoto as a complete objective of certain focal length, then with near objects the corrections must be made, otherwise all the results obtained are wrong.

CORRECTION OF CONVERGENT DISTORTION.

The distorted image must be corrected by copying in the camera on an enlarged scale, with distorted image and enlargement inclined in opposite directions. A corrected and enlarged positive can thus be made from the original negative, or a corrected enlarged negative from a transparency made from the original by contact printing.

Let A = angle of tilt of camera back from vertical at time of original exposure

Let N = angle of inclination from vertical of distorted image in correction process.

Let C = angle of inclination from vertical of new enlarged copy.

Then use original lens, and adjust apparatus to enlarge on scale of 2 to 1, taking measurements on a horizontal line through centre of plate.

Make C equal to A .

Adjust N until convergency disappears.

Stop down as required to secure focus.

Care must be taken to preserve the proper scale of enlargement, which may be upset in adjusting the angles C and N . The enlargement must not be less than 2 to 1, but may be more with advantage.

If A is not recorded it can be easily found, for, when enlarging on scale of 2 to 1, it is equal to $\frac{1}{2}$ the angle of inclination required to remove convergency by tilting either copy or distorted image alone.

If A does not exceed 16° , the method given is sufficiently accurate for all practical purposes. The theoretically exact method is impractically complex.

Though convergency can be corrected by inclining either copy or distorted image alone the result is incorrect, as the height of the image is then either increased or very much dwarfed.

If a reduced corrected copy is required, the required particulars can be taken from the following table. The first column gives the value of r or of $\frac{\text{image}}{\text{object}}$. The second and third the proper values of the angles C and N . The fourth the factor for finding A when that angle is not known, and the fifth the extreme value of A for which the table gives approximately correct results. In applying Column 4 the new copy (or the focussing screen) must be inclined alone until convergency disappears, the negative being upright. A is then equal to the angle found multiplied by the number given. The original lens is to be used.

r	C	N		
1	2	3	4	5
$\frac{1}{2}$	2.6A	2.4A	$\frac{1}{2}$	5°
$\frac{1}{3}$	2.12A	1.87A	$\frac{1}{3}$	7°
$\frac{1}{4}$	1.66A	1.33A	$\frac{1}{4}$	8°
$\frac{1}{5}$	1.45A	1.05A	$\frac{1}{5}$	9°
$\frac{1}{6}$	1.34A	0.9A	$\frac{1}{6}$	11°

When reducing sharp focus can only be secured with the aid of small stop. When enlarging a bigger aperture can be employed.

STEREOSCOPIC FACTS AND FIGURES.

True stereoscopic effect depends on true perspective.

True aerial perspective depends on true gradation and values.

True linear perspective upon absence of distortion, and upon viewing every part of the images at the same angle of convergency as that at which it was seen by the camera lenses.

To secure correct conditions of convergency each print must be seen under the same angle of view as that at which it was produced, and the two prints must be mounted in accord with the following rules.—

Let P = separation of any pair of corresponding points on prints.

N = separation of same points on negatives.

E = separation of eyes (average is 64 mm.).

L = separation of camera lenses.

A non-prismatic stereoscope being used :—

1. If image points represent infinitely distant objects, make $P = E$.

2. If only near objects are shown and an ordinary single plate double lens stereo camera has been used

Make $P = E + L - N$.

3. If a single camera is used for two separate exposures, or if two separate similar cameras are used together, measure N with negatives placed edge to edge and in the same relative positions that they occupied during exposure, and then

Make $P = E - N + \text{length of one plate}$.

If a prismatic stereoscope, fitted with properly centred half lenses is used, add the width of one prism to above values of P

Hints.—1. Aim at soft negatives full of correct gradations, and use printing process showing as little grain and texture as possible.

2. Mount so that horizon line is opposite centre of eyes.

3. Trim so that separation of corresponding margins is only just less than that between images of nearest object.

4. Use light or dark mount according as subject is lighted from the front or back.

5. With very near objects adjust separation of camera lenses until each image shows required amount of subject.

TELEPHOTO CALCULATIONS.

F = equivalent focal length of complete lens.

f_1 = equivalent focal length of positive.

f_2 = equivalent focal length of negative.

E = camera extension, from negative lens to ground glass.

M = magnification, that is number of times the image given by the complete lens is larger than that given by positive alone.

Magnification when working at given extension is found by dividing camera extension by focal length of negative lens and adding 1.

$$M = \frac{E}{f_2} + 1.$$

Camera extension, necessary for given magnification—multiply focal length of negative lens by magnification less 1.

$$E = f_2 (M - 1)$$

Focal length of complete lens.—Multiply focal length of positive by magnification.

DIAPHRAGM NUMBERS.

EQUIVALENT F/- AND UNIFORM SYSTEM NUMBERS.

Rel. Exposure Req'd..	1	2	4	8	16	32	64	128
F Nos.	4	5.6	8	11.3	16	22.6	32	45.2
U.S. Nos.	1	2	4	8	16	32	64	128

NOTE.—Most lenses are now marked with the f/ numbers, although the U.S. numbers are used on Kodak lenses. Also, the actual diameter of the diaphragm aperture in millimetres is marked on Zeiss lenses, such as the “convertible.”

APPROXIMATE INFINITY FOR LENSES OF VARIOUS FOCAL LENGTHS.

By C. WELBORNE PIPER, from “The First Book of the Lens.”

DISTANCE OF FOCUSING-SCREEN BEHIND PRINCIPAL FOCUS.

FOCAL LENGTH, INCHES.	10 in.	20 in.	50 in.	100 in.
1	3 yds.	7½ yds.	15 yds.	30 yds.
2	11	28	55	110
3	25	63	125	250
4	45	113	225	450
5	70	175	350	700
6	100	250	500	1000
7	136	340	680	1360
8	178	½ mile	½ mile	1 mile
9½	264	660 yds.	½ mile	1½ miles
11½	351	½ mile	1	2
12½	434	1085 yds.	1½ miles	2½
13½	525	¾ mile	1½	3
16	700	1	2	4
17½	875	1½ miles	2½	5
19½	1056	1½	3	6
21	1225	1¾	3½	7
22½	1406	2	4	8
24	1600	2½	4½	9
25	1 mile	2½	5	10
28	1½ miles	3½	6½	13
30	1½	3¾	7½	15
33	1¾	4½	9	18
35	2	5	10	20

By focussing accurately on distances not less than those given, we ensure that the focussing-screen is within 100, 250, 500, or, 1000 in. from the true principal focus.

TABLE FOR ENLARGEMENTS.

Focus of Lens, inches	TIMES OF ENLARGEMENT AND REDUCTION.							
	1 inches	2 inches	3 inches	4 inches	5 inches	6 inches	7 inches	8 inches
3	6 6	9 4½	12 4	15 3¾	18 3½	21 3½	24 3¼	27 3¼
3½	7 7	10½ 5½	14 4½	17½ 4¾	21 4½	24½ 4½	28 4	31½ 3⅞
4	8 8	12 6	16 5½	20 5	24 4½	28 4¼	32 4¼	36 4½
4½	9 9	13½ 6½	18 6	22½ 5½	27 5½	31½ 5½	36 5½	40½ 5⅞
5	10 10	15 7½	20 6¾	25 6¼	30 6	35 5¾	40 5½	45 5½
5½	11 11	16½ 8¼	22 7½	27½ 6¾	33 6¾	38½ 6½	44 6½	49½ 6¾
6	12 12	18 9	24 8	30 7½	36 7½	42 7	48 6¾	54 6¾
7	14 14	21 10½	28 9½	35 8¼	42 8½	49 8½	56 8	63 7¾
8	16 16	24 12	32 10¾	40 10	48 9¾	56 9½	64 9½	72 9
9	18 18	27 13½	36 12	45 11¼	54 10¾	63 10½	72 10½	81 10½
10	20 20	30 15	40 13½	50 12½	60 12	70 11¾	80 11¾	90 11½
11	22 22	33 16½	44 14¾	55 13¾	66 13½	77 12¾	88 12¾	99 12¾
12	24 24	36 18	48 16	60 15	72 14¾	84 14	96 13¾	108 13½

The object of this table is to enable any manipulator who is about to enlarge (or reduce) a copy any given number of times, to do so without troublesome calculation. It is assumed that the photographer knows exactly what the focus of his lens is, and that he is able to measure accurately from its optical centre. The use of the table will be seen from the following illustration:—A photographer has a *carte* to enlarge to four times its size, and the lens he intends employing is one of six inches, equivalent focus. He must, therefore, look for 4 on the upper horizontal line, and for 6 in the first vertical column, and carry his eye to where these two join, which will be at 30—7½. The greater of these is the distance the sensitive plate must be from the centre of the lens; and the lesser, the distance of the picture to be copied. To *reduce* a picture any given number of times the *same* method must be followed, but in this case the greater number will represent the distance between the lens and the picture to be copied; the latter, that between the lens and the sensitive plate. This explanation will be sufficient for every case of enlargement or reduction.

RELATIVE EXPOSURES FOR VARYING PROPORTIONS OF IMAGE TO THE ORIGINAL.

(W. E. DEBENHAM'S TABLE.)

To find the relative exposure, add one to the number of times that the length of the original is contained in the length of the image, and square the sum. This will give the figure found in the third column of the annexed table.

As examples: suppose a copy is wanted having twice the linear dimensions of the original. Take the number 2, add 1 to it, and square the sum, $3^2 = 9$. Again, if a copy is to be of eight times the linear dimensions of the original, take the number 8, add 1, and square the sum, $9^2 = 81$. Copies respectively twice and eight times the size (linear) of the original will thus require relative exposures of 9 and 81—i.e., the latter will require nine times the exposure of the former.

It is convenient to have a practical standard for unity. An image of the same size as the original is a familiar case, and serves as such standard. By dividing the figures in the third column by four, we get at the figures in the last column, which represent the exposure required for varying degrees of enlargement or reduction, compared with the exposure for a copy of the same size.

The table is carried up to enlargements of thirty diameters; that is about the amount required for enlarging a *carte-de-visite* to life size.

The exposures required in reductions do not vary at all to the same extent that they do in enlargements. It has, therefore, not been thought necessary to fill in the steps between images of $\frac{1}{10}$ and $\frac{1}{20}$ and between $\frac{1}{20}$ and $\frac{1}{30}$ of the size of the original. Beyond $\frac{1}{30}$ there is scarcely any perceptible difference in the exposure until disturbance comes in from another cause, a considerable distance of illuminated atmosphere (haze or fog) intervening.

The figures in the second column will also serve as a table for distances from the lens to the plate and to the original, all that is necessary being to multiply by the principal focus of the lens in use. In the case of enlargements the figures less than 2 must be multiplied to get the distance from the original to the lens, and the figures greater than 2 for the distance from lens to image. For reductions the figures less than 2, multiplied by the principal focus of the lens, yield the distance from lens to plate; and the figures higher than 2, similarly multiplied, give the distance of original from lens.

With single "view lenses" the size of the effective aperture is different on the two sides of the lens, and the rapidity of the lens therefore varies with the side presented to the original. Therefore exposures can only be compared by the table when the same side of the lens is towards the original. The aperture also varies with the distance of the original, and the table does not accurately apply when enlarging. When reducing with a single lens the table gives approximately accurate results. It only applies accurately in all circumstances with doublets.

Proportion of image to original (linear).	Distance of image from lens* in terms of principal focus.	Proportionate exposures.	Exposures proportioned to that required for copying same size.
$\frac{1}{3.0}$	$1\frac{1}{3.0}$	1.07	0.27
$\frac{1}{2.0}$	$1\frac{1}{2.0}$	1.10	0.28
$\frac{1}{1.5}$	$1\frac{1}{1.5}$	1.21	0.3
$\frac{1}{1.2}$	$1\frac{1}{1.2}$	1.27	0.31
$\frac{1}{1.0}$	$1\frac{1}{1.0}$	1.36	0.34
$\frac{1}{0.8}$	$1\frac{1}{0.8}$	1.56	0.39
$\frac{1}{0.6}$	$1\frac{1}{0.6}$	2.25	0.56
$\frac{1}{0.5}$	$1\frac{1}{0.5}$	3.06	0.76
(Same size) 1	2	4	1
2	3	9	2.25
3	4	16	4
4	5	25	6.25
5	6	36	9
6	7	49	12.25
7	8	64	16
8	9	81	20.25
9	10	100	25
10	11	121	30.25
11	12	144	36
12	13	169	42.25
13	14	196	49
14	15	225	56.25
15	16	256	64
16	17	289	72.25
17	18	324	81
18	19	361	90.25
19	20	400	100
20	21	441	110.25
21	22	484	121
22	23	529	132.25
23	24	576	144
24	25	625	156.25
25	26	676	169
26	27	729	182.25
27	28	784	196
28	29	841	210.25
29	30	900	225
30	31	961	240

* With a double lens it is usually sufficient to measure from the position of the diaphragm plate.

TABLE OF VIEW-ANGLES.

By CLARENCE B. WOODMAN, Ph.D.

DIVIDE THE BASE* OF THE PLATE BY THE EQUIVALENT FOCUS OF THE LENS.

If the quotient is	The angle is	If the quotient is	The angle is	If the quotient is	The angle is
	Degrees		Degrees		Degrees.
0.282	16	0.748	41	1.3	66
0.3	17	0.768	42	1.32	67
0.317	18	0.788	43	1.36	68
0.335	19	0.808	44	1.375	69
0.353	20	0.828	45	1.4	70
0.37	21	0.849	46	1.427	71
0.389	22	0.87	47	1.45	72
0.407	23	0.89	48	1.48	73
0.425	24	0.911	49	1.5	74
0.443	25	0.933	50	1.53	75
0.462	26	0.954	51	1.56	76
0.48	27	0.975	52	1.59	77
0.5	28	1.0	53	1.62	78
0.517	29	1.02	54	1.649	79
0.536	30	1.041	55	1.678	80
0.555	31	1.063	56	1.7	81
0.573	32	1.086	57	1.739	82
0.592	33	1.108	58	1.769	83
0.611	34	1.132	59	1.8	84
0.631	35	1.155	60	1.833	85
0.65	36	1.178	61	1.865	86
0.67	37	1.2	62	1.898	87
0.689	38	1.225	63	1.931	88
0.708	39	1.25	64	1.965	89
0.728	40	1.274	65	2.0	90

Example.—Given a lens of 13 inches equivalent focus; required the angle included by it on plate $3\frac{1}{2} \times 4\frac{1}{2}$.

Dividing 4.23 by 13, we have as quotient 0.327—midway between the decimals 0.317 and 0.335 of our table; therefore the required angle is $18^{\circ} 30'$.

*More accurately the diagonal of the plate, inasmuch as the field of the lens is circular, and if the corners of the plate are to be covered the angle embraced by the lens should be sufficient to cover the diagonal of the plate

The lengths of the diagonals of the plates most commonly used are:—

$3\frac{1}{2} \times 3\frac{1}{2}$	diagonal 4.6 inches.	$7\frac{1}{2} \times 5$	diagonal 9.0 inches
$3\frac{1}{2} \times 4\frac{1}{2}$	" 5.3 "	$6\frac{1}{2} \times 8\frac{1}{2}$	" 10.7 "
5×4	" 6.4 "	10×18	" 12.8 "
$4\frac{1}{2} \times 6\frac{1}{2}$	" 8.0 "	12×10	" 15.6 "
7×5	" 8.6 "	15×12	" 19.2 "

MR. E. M. NELSON'S TABLE OF DISTANCES FOR LANTERN PROJECTION.
DISTANCE OF PROJECTION LENS FROM SCREEN, MASK BEING THREE INCHES.

Foci	4½	5	5½	6	7	8	9	10	11	12	14	16	18
Disc.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
5	7 10½	8 9	9 7½	10 6	12 3	14 0	15 9	17 6	19 3	21	24 6	26 3	31 6
6	9 4½	10 5	11 5½	12 6	14 7	16 8	18 9	20 10	22 11	25	29 2	31 3	37 6
7	10 10½	12 1	13 3½	14 6	16 11	19 4	21 9	24 2	26 7	29	33 10	36 3	43 6
8	12 4½	13 9	15 1½	16 6	19 3	22 0	24 9	27 6	30 3	33	38 6	41 3	49 6
9	13 10½	15 5	16 11½	18 6	21 7	24 8	27 9	30 10	33 11	37	43 2	46 3	55 6
10	15 4½	17 1	18 9½	20 6	23 11	27 4	30 9	34 2	37 7	41	47 10	51 3	61 6
11	16 10½	18 9	20 7½	22 6	26 3	30 0	33 9	37 6	41 3	45	52 6	56 3	67 6
12	18 4½	20 5	22 5½	24 6	28 7	32 8	36 9	40 10	44 11	49	57 2	61 3	73 6
13	19 10½	22 1	24 3½	26 6	30 11	35 4	39 9	44 2	48 7	53	61 10	66 3	79 6
14	21 4½	23 9	26 1½	28 6	33 3	38 0	42 9	47 6	52 3	57	66 6	71 3	85 6
15	22 10½	25 5	27 11½	30 6	35 7	40 8	45 9	50 10	55 11	61	71 2	76 3	91 6
16	24 4½	27 1	29 9½	32 6	37 11	43 4	48 9	54 2	59 7	65	75 10	81 3	97 6
18	27 4½	30 5	33 5½	36 6	42 7	48 8	54 9	60 10	66 11	73	85 2	91 3	109 6
20	30 4½	33 9	37 1½	40 6	47 3	54 0	60 9	67 6	74 3	81	94 6	101 3	121 6
25	37 10½	42 1	46 3½	50 6	58 11	67 4	75 9	84 2	92 7	101	117 10	126 3	151 6
30	45 4½	50 5	55 5½	60 6	70 7	80 8	90 9	100 10	110 11	121	141 2	151 3	181 6
35	52 10½	58 9	64 7½	70 6	82 3	94 0	105 0	117 6	129 3	141	164 6	176 3	211 6
40	60 4½	67 1	73 9½	80 6	93 11	107 4	120 9	134 2	147 7	161	187 10	201 3	241 6
45	67 10½	75 5	82 11½	90 6	105 7	120 8	135 9	150 10	165 11	181	211 2	226 3	271 6
50	75 4½	83 9	92 1½	100 6	117 3	134 0	150 9	167 6	184 3	201	234 6	251 3	301 6

TABLE OF DISTANCES FOR AN OBJECT OF SIXTY-EIGHT INCHES HEIGHT.

COMPUTED BY P. BROSIG.

FOURTH FOOT		HEIGHTS OF IMAGES (INCHES).															
1	2	3	4	6	8	10	12	14	16	20	24	28	32	40	48	56	68
2	138-0 2-0	70-0 2-1	47-3 2-1	36-0 2-1													
3	207-0 3-0	105-0 3-1	71-0 3-1	54-0 3-2	37-0 3-3												
4	276-0 4-1	140-0 4-1	91-7 4-2	72-0 4-2	49-3 4-4	38-0 4-5											
5	345-0 5-1	175-0 5-1	118-3 5-2	90-0 5-3	61-7 5-4	47-5 5-6	39-0 5-7										
6	414-0 6-1	210-0 6-2	142-0 6-3	108-0 6-4	74-0 6-5	57-0 6-7	46-8 6-9	40-0 7-1	35-1 7-2								
7	483-0 7-0	245-0 7-1	165-7 7-3	126-0 7-4	86-3 7-6	66-5 7-8	54-6 8-0	46-7 8-2	41-0 8-4	36-7 8-6							
8	552-0 8-1	280-0 8-2	189-3 8-4	144-0 8-5	98-7 8-7	76-0 8-9	62-4 9-2	53-3 9-4	46-9 9-6	42-0 9-9	35-2 10-4						
9	621-0 9-1	315-0 9-3	213-0 9-4	162-0 9-5	111-0 9-8	85-5 10-1	70-2 10-3	60-0 10-6	52-7 10-9	47-2 11-1	39-6 11-6						
10	690-0 10-1	350-0 10-3	236-7 10-4	180-0 10-6	123-3 10-9	95-0 11-2	78-0 11-5	66-7 11-8	58-6 12-1	52-5 12-4	44-0 12-9	38-3 13-5	34-3 14-1				
11	759-0 11-2	385-0 11-3	260-3 11-5	198-0 11-6	135-7 12-0	104-5 12-3	85-8 12-6	73-3 12-9	64-4 13-3	57-7 13-6	48-4 14-2	42-2 14-9	37-7 15-5	34-4 16-2			
12	828-0 12-2	420-0 12-4	284-0 12-5	216-0 12-7	148-0 13-1	114-0 13-4	93-6 13-8	80-0 14-1	70-3 14-5	63-0 14-8	52-8 15-5	46-0 16-2	41-1 16-9	37-5 17-6			
13	897-0 13-2	455-0 13-4	307-7 13-6	234-0 13-8	160-3 14-1	123-5 14-5	101-4 14-9	86-7 15-3	76-1 15-7	68-2 16-1	57-2 16-8	49-8 17-6	44-6 18-4	40-6 19-1	35-1 20-6		

Values are omitted in this space on account
of the wide angle of space required.
(More than ninety degrees.)

14	996-0 14-2	490-0 14-4	331-3 14-6	257-0 14-8	172-7 15-2	133-0 15-6	109-2 16-1	93-3 16-5	82-0 16-9	73-5 17-3	61-6 18-0	53-7 18-9	48-0 19-8	43-3 20-7	37-8 22-2		
16	1104 16-2	560-0 16-5	378-7 16-7	288-0 16-9	197-3 17-4	152-0 17-9	124-8 18-4	106-7 18-8	93-7 19-3	84-0 19-8	70-7 20-7	61-3 21-6	54-9 22-6	50-0 23-5	43-2 25-4	38-7 27-3	35-4 29-2
18	1242 18-3	630-0 18-5	426-0 18-8	324-0 19-1	222-0 19-6	171-0 20-1	140-4 20-6	120-0 21-2	105-4 21-7	94-5 22-2	79-2 23-3	69-0 24-4	61-7 25-4	56-2 26-5	48-7 28-6	43-5 30-7	39-9 32-8
20	1380 20-3	700-0 20-6	473-3 20-9	360-0 21-2	246-7 21-8	199-0 22-4	156-0 23-5	133-3 24-1	117-1 24-7	105-0 25-2	88-0 26-7	76-7 27-7	68-6 28-6	62-5 29-4	54-0 31-8	48-3 34-1	44-3 36-5
22	1518 22-3	770-0 22-6	520-7 23-0	396-0 23-3	271-3 23-9	209-0 24-6	171-6 25-2	146-7 25-9	128-9 26-5	115-5 27-2	96-8 28-5	84-3 29-8	75-4 31-1	68-7 32-4	59-4 35-9	53-2 37-6	48-7 40-1
24	1656 24-4	840-0 24-7	568-0 25-1	432-0 25-4	296-0 26-1	228-0 26-8	187-2 27-5	160-0 28-2	140-6 28-9	126-0 29-6	106-6 31-1	92-0 32-5	82-3 35-9	75-0 38-1	64-8 40-9	58-0 43-8	53-1 48-0
26	1794 26-4	910-0 26-8	615-3 27-1	488-0 27-5	320-6 28-3	247-0 29-0	202-8 29-8	173-3 30-6	152-3 31-3	136-5 32-1	114-4 33-6	99-7 35-2	89-1 36-7	81-2 38-2	70-2 41-3	62-8 44-4	57-6 49-0
28	1932 28-4	980-0 28-8	662-7 29-2	504-0 29-6	345-3 30-5	266-0 31-3	218-4 32-1	186-7 32-9	164-0 33-8	147-0 34-6	123-2 36-2	107-3 37-9	96-0 39-5	87-5 41-2	75-6 44-5	67-7 47-8	62-0 51-1
32	2208 32-5	1120 32-9	757-3 33-4	576-0 33-9	394-7 34-8	304-0 35-8	249-6 36-7	213-3 37-6	187-4 38-6	168-0 39-5	140-8 41-4	122-7 43-3	109-7 45-2	100-0 47-1	86-4 50-8	77-3 54-6	70-9 58-4
36	2484 36-5	1260 37-1	852-0 37-6	648-0 38-1	444-0 39-2	342-0 40-2	280-8 41-3	240-0 42-4	210-9 43-4	189-0 44-5	158-4 46-5	138-0 48-7	123-4 50-8	112-5 52-9	97-2 57-2	87-0 61-4	79-7 65-6
44	3036 44-6	1540 45-3	1041 45-9	792-0 46-7	542-7 47-9	418-0 49-2	343-2 50-6	293-3 51-8	257-7 53-1	231-0 54-3	193-6 56-9	168-7 59-6	150-9 62-1	137-5 64-7	118-8 69-9	106-3 75-1	97-4 80-2
52	3588 52-8	1820 53-5	1231 54-3	936-0 55-1	641-3 56-6	494-0 58-1	405-6 59-6	346-7 61-2	304-6 62-7	273-0 64-2	228-8 67-3	199-3 70-4	178-3 73-4	162-5 76-5	140-4 82-6	125-7 88-7	115-1 94-8

This table gives, in inches, the distances from lens to object (greater conjugate focus, upper number) and from lens to ground glass (lesser conjugate focus, lower number) for different heights of images and different lengths of foci of lenses, when the height of object is 88 inches (=average height of man). EXAMPLES.

Q.—What is the height of image of a person who is 133 inches distance from lens, when a lens of 14 inches focus is used?

A.—The height of image in this case is 8 inches.

Q.—What are the distances between object, lens, and ground glass if the image of a person is to be 8 inches high and a 14 inches focus lens is employed?

A.—The distance from object to lens will be 133 inches, from lens to ground glass 15-6 inches.

**TABLES OF DISTANCES AT AND BEYOND WHICH ALL
OBJECTS ARE IN FOCUS WHEN SHARP FOCUS IS
SECURED ON INFINITY.**

Focal length of Lens in inches.	Ratio marked on Stops.															
	<i>f</i> /4	<i>f</i> /5.6	<i>f</i> /6	<i>f</i> /7	<i>f</i> /8	<i>f</i> /10	<i>f</i> /11	<i>f</i> /15	<i>f</i> /16	<i>f</i> /20	<i>f</i> /22	<i>f</i> /32	<i>f</i> /44	<i>f</i> /64		
	Number of feet after which all is in focus.															
4	33	24	22	19	17	13	12	9	8	7	6	4	3	2		
4½	38	27	25	21	19	15	14	10	10	7	7	5	3½	2		
4¾	42	30	28	24	21	17	15	11	11	8½	7½	5½	4	3		
5	47	34	31	27	24	19	17	12	12	9½	8½	6	5	3		
5½	52	36	35	30	26	21	19	14	13	10½	9½	6½	5½	3½		
5¾	57	40	38	33	28	23	21	15	14	11½	10½	7	5½	3½		
6	63	45	43	36	31	25	23	17	15	12½	11½	7½	6	4		
6½	68	50	46	38	34	27	25	18	17	13½	13	8½	6½	4		
7	75	54	50	42	38	30	28	20	19	15	14	9	7	4½		
7½	81	58	54	46	40	32	29	22	20	16	15	10	7½	5		
8	87	62	58	50	44	35	32	23	22	17½	16	11	8	5½		
8½	94	67	63	54	47	38	34	25	24	19	17	12	8½	6		
9	101	72	68	58	51	40	37	27	25	20	18	12½	9	6		
9½	109	78	73	62	54	44	39	29	27	22	20	13½	10	6½		
10	117	83	78	64	58	47	42	31	29	24	21	14½	10½	7		
10½	124	90	83	71	62	50	45	33	31	25	22	15½	11	7½		
11	132	96	88	76	68	52	48	36	32	28	24	16	12	8		
11½	141	100	94	80	71	56	51	37	35	29	25	17½	12½	8½		
12	150	104	100	84	76	60	56	40	38	30	27	19	13½	9		
12½	155	111	104	89	73	63	57	42	39	32	29	20	14	10		
13	168	120	112	96	84	67	61	45	42	34	31	21	15	10½		
13½	180	127	116	101	90	71	65	47	45	35	32	22	16	11		
14	190	133	125	107	95	75	68	50	47	37	34	24	17	12		
14½	197	141	131	113	99	79	72	52	50	39	36	25	18	12½		
15	208	148	140	120	104	83	75	55	52	42	38	26	19	13		

If sharp focus is secured on any of the distances shown, then, with the stop indicated, all objects are in focus from half the distance focussed on up to infinity.

